THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

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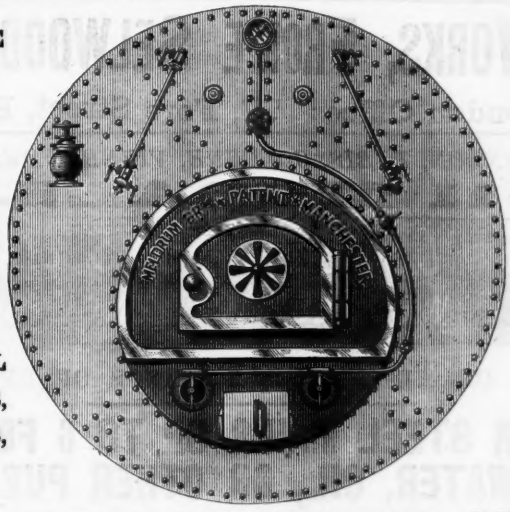

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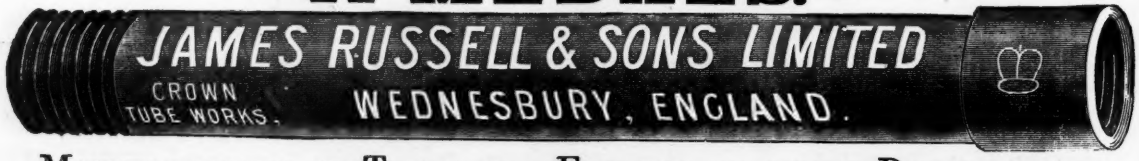

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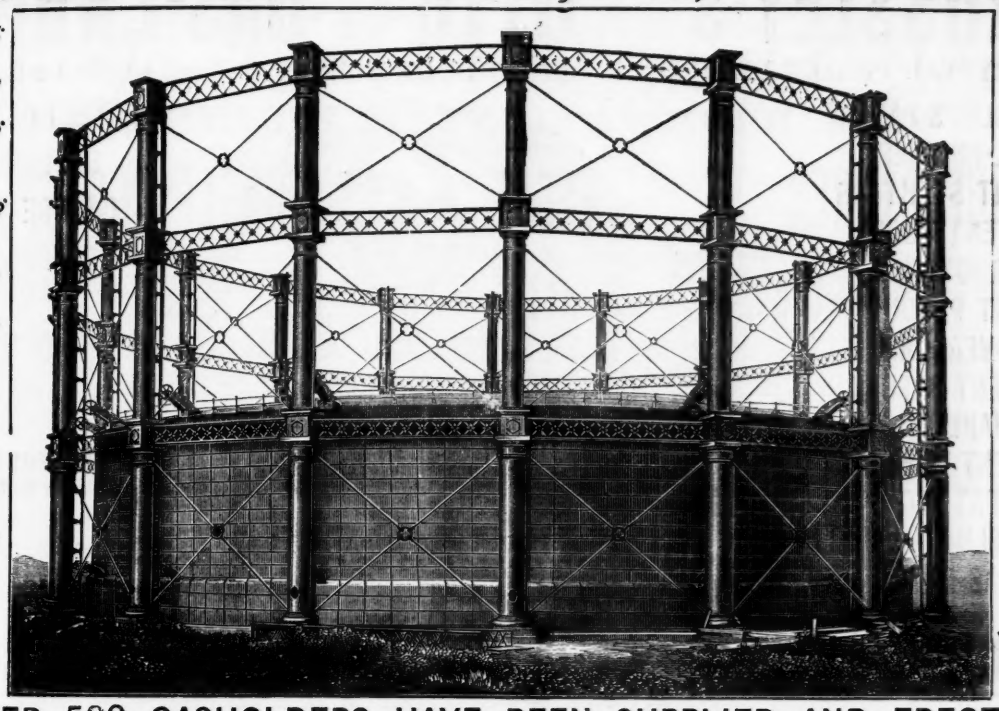

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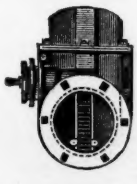

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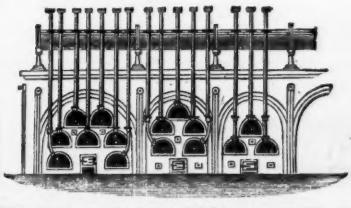

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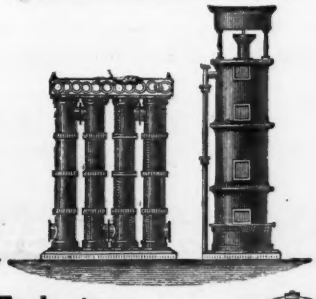

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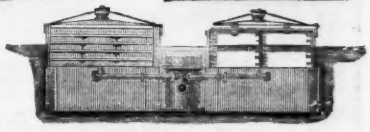

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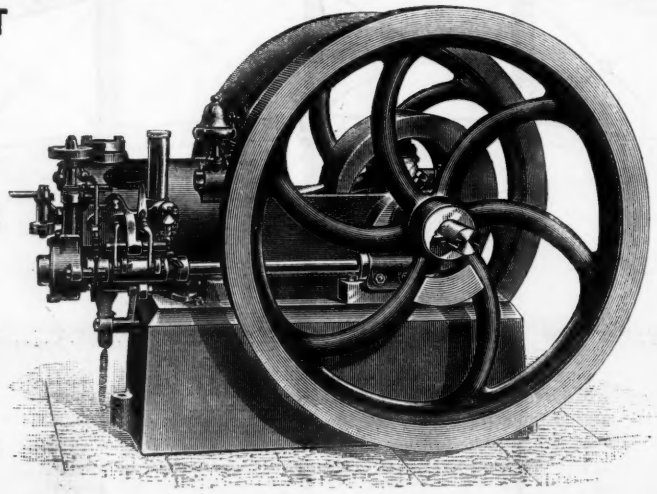

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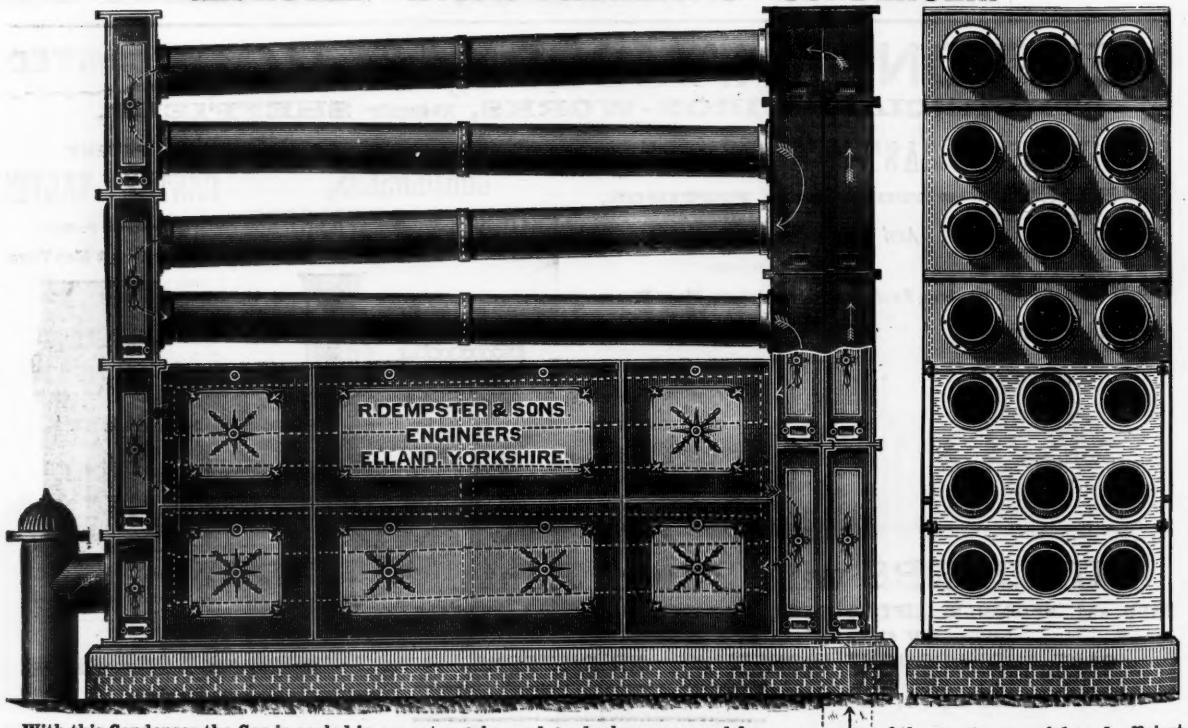

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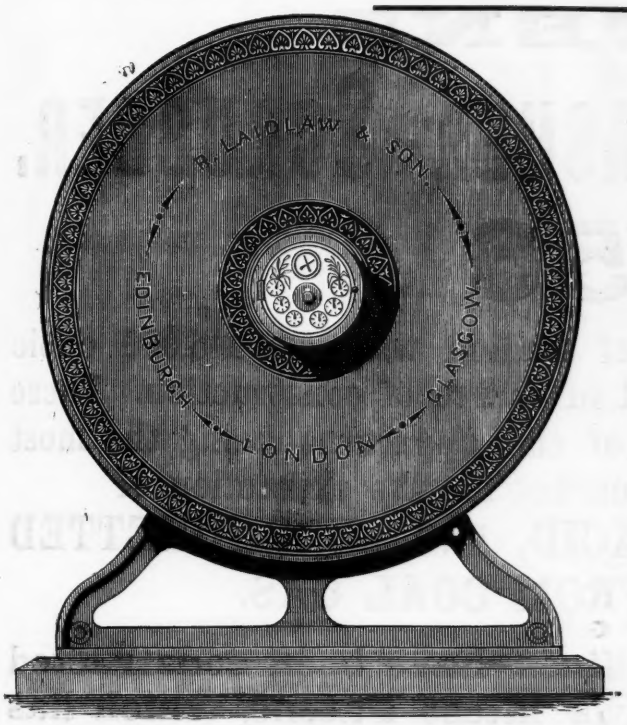

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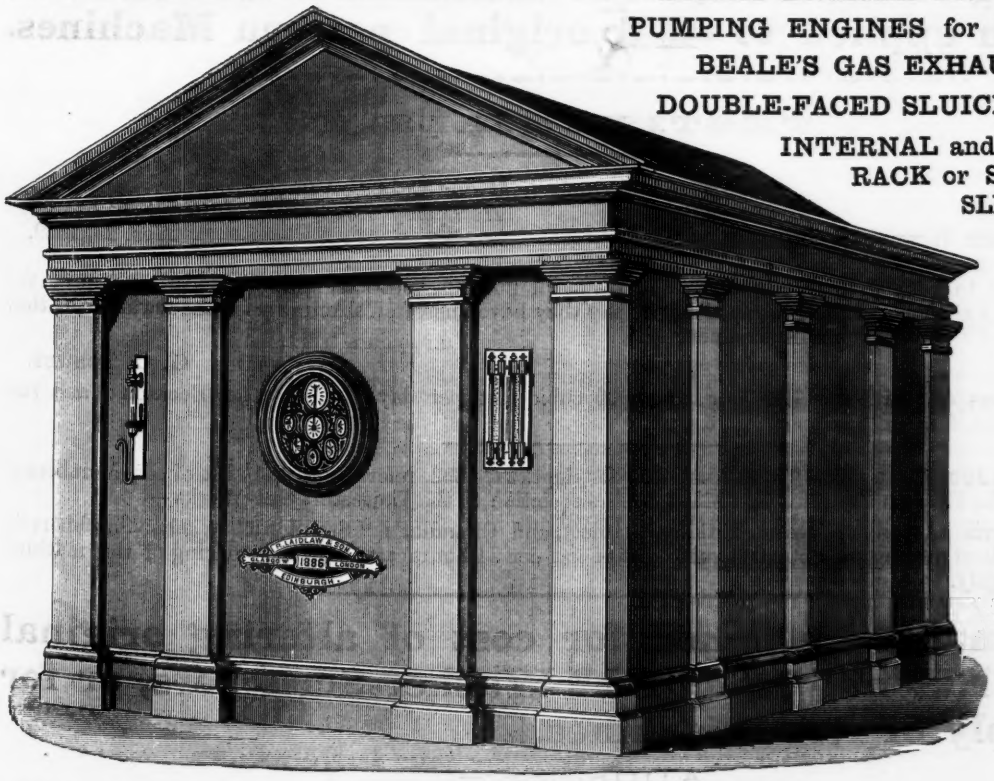

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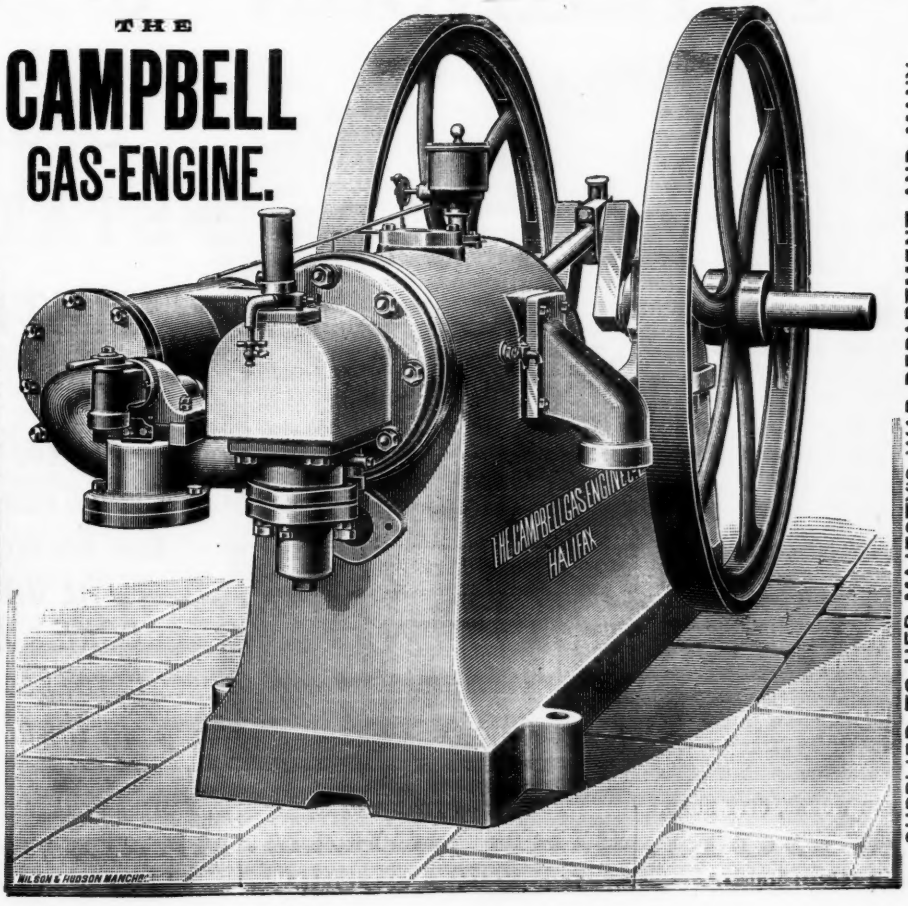

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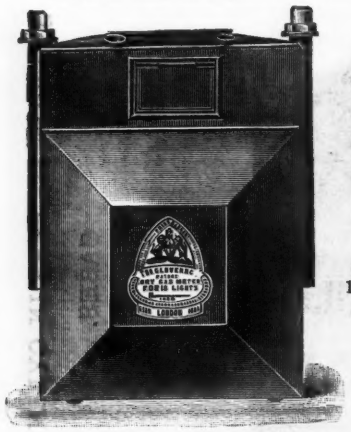

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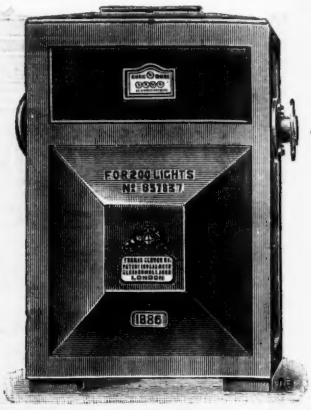

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TO CORRESPONDENTS.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 6, 1892.

Tar-Well Explosion at Bradford.

LAST Saturday afternoon, a disastrous explosion occurred at the Valley Road Gas-Works of the Bradford Corporation, resulting in the death of the works foreman—Mr. Joseph Milner—more or less serious injury to four workmen, and much damage to buildings and property. The explosion originated in the tar-tanks, which are described in the newspaper accounts of the catastrophe that have come to hand as being of large capacity, and very strong construction. They occupy a site contiguous to the retort-houses, and the condensing and purifying plant; and they were covered with arches—the upper surface forming a yard, in which a horse and cart happened to be standing at the moment of the explosion. The horse was killed, the cart scattered in fragments, the condensers thrown down, and the retort-houses so far wrecked that it was afterwards found that the gas-producing capacity of the station was reduced to one-third. The upheaval of the yard appears to have been of a volcanic type; everything in the way of buildings and ironwork surrounding it being shaken from the foundations. The unfortunate foreman was at the northern end of the yard, and close by the centre of explosion. He was knocked down, and afterwards struck by falling fragments of wreckage. Flames of ignited gas burst forth after the explosion, and one or two of the injured men were burnt thereby. But the gas was very soon cut off, and there was nothing like a general conflagration.

The first question that suggests itself is as to the cause of the explosion, which seems to be as much a mystery as that at Nottingham last July, which, by a remarkable coincidence, was discussed at the recent meeting of the Manchester District Institution of Gas Engineers. We observed last week that "any instance of the explosion of gas or of "inflammable vapour in connection with gas making has "lessons of general applicability;" but little did we anticipate that before the week was out our comment would receive such vivid endorsement. Less happy as regards the consequences of the mishap than the Nottingham Gas Committee, the Bradford Corporation will have to explain their works arrangements to a Coroner's jury; and we can therefore say nothing more now about the effects of this deplorable proof of the dangers lurking in tar-wells than giving expression to the sympathy which will be felt throughout the gas engineering world, not only for the victims of the present catastrophe, but also for the Gas Committee and their officers. It is most desirable that the affair should be thoroughly investigated, in order that the nature of the precautions requisite to prevent repetitions of such explosions may be ascertained. There have been many instances of the firing of tar-wells, and some few explosions; and it looks as if the latter are inclined to come more in evidence, which is probably due to the growth of the practice of covering the tanks tightly down with a view to the repression of noxious emanations from the supernatant liquor.

There is always a question, when anything of the kind happens, as to whether it is coal gas or hydrocarbon vapour from the tar itself that enters into the composition of the explosive mixture. This is a problem that must be studied with strict reference to local data. An equally curious and important inquiry is as to how the explosive mixture, whatever its composition, has been fired. Here again local considerations stand for much. Nobody can say what extraordinary concatenation of circumstances may occur at a given moment of time, and in a particular place, to bring about a result impossible of attainment under ordinary conditions. Truth is proverbially stranger than fiction; and the worst of it is that whereas man can make up his own fiction, and do it so well sometimes as to believe in it himself, the truth respecting the fatal collaboration of dumb matter in the production of a mysterious casualty has no voice audible by mankind.

The Parliamentary Notices.

ALL the parliamentary notices of Private Bills for the ensuing session are now to hand; and the list of those relating to gas and water supply will be found in another column. The Private Bill business for the session shows a marked falling off; not more than 172 applications of all kinds being filed, as compared with 214 for last session. At this rate, the old difficulty of dealing with this order of parliamentary business will soon settle itself. It is not worth while to trouble oneself about the reform of Private Bill Procedure if there are hardly any Bills to be dealt with. And now that the House of Commons keeps good hours, there is less risk of the old scandals of somnolent and preoccupied committeemen being repeated. It is quite possible that the prevalent uncertainty with regard to the duration of the present Parliament may have operated to keep away Private Bills that do not happen to be urgent; but, whatever the cause, the fact remains that Westminster has a dull session to look forward to. So far as gas supply is concerned, the outlook is particularly blank. The Crystal Palace District Gas Company's Bill, already discussed in these columns, appears to be the most important of its kind in the list; although it is, of course, quite possible that the Brighton and Hove Gas Company may have a fight over their Bill, and

there are one or two other Provincial Gas Companies and Corporations who will scarcely get the statutory privileges for which they ask without more or less of a struggle. Nor is the slackness in the Private Bill Office compensated for by any briskness in the Provisional Order line. The Sheffield United Gas Company are proceeding by Order to obtain some important modifications of their present statutory conditions; but there is nothing strange in this, as the Company have already given proof of their appreciation of the Gas and Water Works Facilities Act, 1870. An application is to be made to the Local Government Board by the Bideford Corporation, which is interesting in a particular sense. The Corporation are desirous of acquiring the undertaking of the Bideford Gas Company; and in the event of their attaining the object of their desire, they will be the first Local Authority in the West of England to supply gas on their own account. It is remarkable how geographical considerations have hitherto appeared to operate in the matter of the transfer of gas undertakings from companies to local authorities. There is no reason, in the nature of things, why gas supply should not have been taken in hand by southern or western municipalities as freely as it has been by those of the northern portion of the kingdom; but the latter have not only taken the lead in this respect, but have kept it. There is absolutely nothing to comment upon in the remaining parliamentary notices, which appear to be of the most ordinary kind.

The Sunday in Gas-Works.

Some rather remarkable statements respecting the subject of Sunday labour in gas-works were made before the Labour Commission by Dr. Gritton, the Secretary of the Lord's Day Observance Society; and we have accordingly had this evidence specially reported, as will be seen in another column. It will not form pleasant reading for some people; and this is a strong reason for giving it in full. Dr. Gritton appears to have gone about to gas-works in different parts of the country on Sundays, taking notes of what he saw going on; and his observations are distinctly interesting. At Leicester, for instance, the worthy gentleman came face to face with the question of principle involved in the institution of a day of rest. Even a clergyman and an outsider like the reverend Doctor was struck with the material completeness of the Leicester Corporation Gas-Works, of which he spoke in terms of sincere admiration. But here, in this most modern of our gas-making establishments, no difference is made for Sunday in the carbonizing work. It is furthermore reported that "the reason which "the Engineer gave for carrying on the carbonizing work "without any cessation on Sunday was that he thought it "good for the men that they should not be entirely thrust "out of their usual work, and be loitering about with "nothing to do." If Mr. Colson is fairly reported here, it will strike most people that he must regard the Sunday's rest as a bad thing in principle, and would like to abolish it in all departments of the Leicester gas undertaking as well as everywhere else. We seem to hear an echo of Mr. William King in the remarks Dr. Gritton had to make about the gas stokers of Liverpool. There is a good deal of human nature in stokers; and the humour of their tricks for getting Sunday work, because it is paid for at a higher rate, is worth more than a passing notice. The witness did not, however, appear to thoroughly understand the subject. Dr. Gritton "drew" Mr. George Livesey upon the question of the cost of abolishing Sunday gas making, which he gave on Mr. Livesey's authority at between ¾d. and 1¼d. per 1000 cubic feet upon the total make. Mr. Livesey demurred to this; but the point might as well be cleared up. We are disposed to agree with Dr. Gritton that, if it is right and practicable to stop gas making on Sundays, the consideration of a fractional increase in the cost of manufacture ought not to prevent its being done. The witness told a strange tale about Stockton; making it appear that the stokers had succeeded in getting Secularist town councillors returned in order to counteract the plans of the Manager of the gas-works for a total stoppage on Sundays. This also is a matter that needs explaining. We should not he surprised to learn that, where what are called "advanced" views in municipal politics hold sway, the desirability of observing Sunday as a day of rest is regarded as at least questionable. There can be no doubt that Social Democrats and their congeners and allies treat the Sunday rest as a rusty superstition; and it does not take much penetration into motives to see that, if a Social Democrat insists that Sunday labour shall be paid at something more than the ordinary rate, he will not allow this regulation to remain a dead letter if he can help it. The rest on Sunday from the ordinary avocations of the week is not, and never was, a popular institution—meaning one enacted by the people for the people. It was imposed upon the community by an authority that nobody thought of questioning, still less of disobeying. Now, however, there is no longer any authority higher in the estimation of the New Trades Unionist than that of his Branch Secretary; and Sunday is going the way of so many other old-fashioned practices dating from the days of reverence.

Information Wanted.

Is it not time that somebody came forward with a definite statement as to the cost and other particulars of carburetted water gas as now made—or not made, as the case may be—in those British gas-works which are known by common rumour to have embarked upon experiments with this delectable compound? It is popularly supposed to be produced in considerable quantities at Beckton, with what results is not stated; but report has it that the mixture shows its traces in the street syphons a long way from its place of origin. Is it true that the Springer plant has proved an utter failure at the Old Kent Road, after the Syndicate who were interested in the English prospects of the Springer system had expended all their subscribed capital? Where is this great inventor at present? What about the brand-new system that was to work wonders for the Brentford Company? If anybody knows the recent history of the water-gas propaganda in British gas-works, now is the time for him to tell it. Writing in the Journal for the 1st ult., Messrs. Humphreys and Glasgow preferred, in terms which might have been more precise, the claim that it is advantageous for British gas manufacturers to make carburetted water gas "where gas is required of "an illuminating value higher than that yielded by ordi-"nary gas coals." We have great respect for Messrs. Humphreys and Glasgow, individually and collectively; but our readers would naturally like to hear somebody else, and somebody who has tried the thing, tell how water gas works in the ordinary way. If there have been any failures, and if the introduction of carburetted water gas has been attended with some novel and remarkable phenomena, it is only fair to the systems not implicated that the facts should be made known upon unimpeachable authority; for, to the uninitiated, one system of making water gas is the same as another. Meanwhile, the idea is being "boomed" in a fresh quarter; a Belfast gentleman having allowed it to be known that he has specially imported the "Harris" water-gas process, which is well spoken of in "Maysville, Connorsville," and other centres of American civilization, as turning out illuminating gas for about 4d. per 1000 cubic feet. He is apparently willing to have a contract to supply Belfast at this figure; and provided he is agreeable to take payment by results, it is to be hoped the Belfast Corporation will let him try it. We hear also that the Lawrence "greased air" project is to be warmed up again—if the term is applicable to a "cold"—a very cool—process for extracting money from the confiding speculator. There is money to be raised for working a really good and new gas-making process, when anything of the kind can be put upon the market properly recommended. The invincible ignorance of the public ascribes to the gas companies profound indifference to novelties in gas manufacture, as we had to mention last week with special reference to the *Engineer* and its views upon the gas industry. This reputation for indifference to novelties is supported by the reluctance of some gas managers to say anything about the failures with which they have been connected, even when no sort of responsibility for such failure can attach to themselves. Consequently, the most instructive instances of collapse have to be hunted out; and this by no means pleasant duty generally falls upon us. We shall probably not be thanked for throwing down the challenge with which this paragraph commences; but it is not just to others in the same boat if the projectors of worthless water-gas or other schemes escape from giving the public lesson which is the most generally valuable part of their failures.

Further Experiments with Anthracite.

It is impossible to conceive of a more touching illustration of the poet's remark that "hope springs eternal in the

"human breast" than the fact, announced in certain newspapers, of another attempt having been made to domicile the anthracite coal fire in London. It even appears that a joint-stock company has been formed to take in hand the desperate task of persuading the London householder to burn anthracite in his domestic fireplaces instead of the usual bituminous coal; and a "press view" of the Company's performance has been held, with the usual result of a crop of ingenious reporters' testimonials to the success of the great "novelty." So far as can be ascertained, the new departure by virtue of which anthracite is to be burnt in place of the less austere kind of coal, simply consists in making grates with vertical instead of horizontal bars. Another novelty! We take notice of these reports because the reason which prevents householders in the larger part of Great Britain from burning anthracite to warm their rooms, is the same as that which shuts out coke from the domestic hearth—people do not like it. It is useless to assure a man that anthracite or coke will answer every reasonable requirement of a fuel for domestic use, if he, or, as generally happens, his wife, will not have it at any price. Indeed, the difficulty of prevailing upon people living anywhere except in a particular corner of Wales to burn anthracite, is even greater than that of inducing them to try coke; for the latter description of fuel is cheap, whereas anthracite is dear. Anthracite possesses every disadvantage, as compared with good blazing coal, that can be ascribed to coke, with one or two additional ones of its own, such as the unpleasant odour and high price. We have often argued that, if coal were as dear and dirty in London as in Paris, coke would become the favourite fuel here as it is there. Until this condition is realized, however, we shall not entertain any illusions on the subject of the popularity of coke in ordinary households; and it would be well for people interested in anthracite to keep their minds equally free from flattering conceits.

WATER AND SANITARY AFFAIRS.

THE provision of a proper water supply for different parts of the country leads every year to the bringing of sundry Bills into Parliament, either for the extension of existing works or the establishment of new undertakings. The transfer of the water supply from a private company to a public authority also calls for the authorization of the Legislature. In another column will be found our usual summary of the Bills to be introduced in the next session of Parliament; and it may be said that, although there is no specially remarkable project coming forward, in the aggregate a very considerable amount of activity displays itself, involving a large expenditure of capital for the purpose of meeting the wants of an ever-increasing population in respect to the supply of water. The London County Council is constrained for the present to adopt a policy of expectation rather than of action, pending the report of the Royal Commission on Metropolitan Water Supply. It asks for all the powers which may be necessary relative to inquiries and negotiations connected with local government—comprehending water supply among other things. The Council also seeks for representation on the Thames and Lea Conservancy Boards. As affecting the Metropolis, we find the East London Water Company giving notice of a Bill by which they are to be authorized to raise additional capital, not exceeding half-a-million, to be employed chiefly in purchasing additional land, sinking wells, constructing reservoirs, and laying down mains and pipes, with a view to meet the increasing demand for water within their existing limits of supply. Further provision is sought for preventing the waste, misuse, or undue consumption of water. Interference with the fittings or property of the Company is also to be checked. The East London Water Company, as giving a constant supply to all their intra-Metropolitan area, and nearly all that portion lying outside the Metropolis, are especially interested in seeing that their customers are provided with effective fittings. Great care has been taken by the Company to prevent waste; but, after defects have been detected and remedied, the character of the fittings is such that—according to the statement made to General Scott—the mischief soon re-asserts itself, and becomes as bad as ever. This is a matter where Parliament is bound to assist the Company, if there is any supposed need for economizing the sources whence the present supply of water is drawn. No other London Water Comapny will come before Parliament in the ensuing session.

Passing on to the city which stands next to London in extent of population, we find the Corporation of Liverpool giving notice of a General Powers Bill, including clauses authorizing the raising of money for the purpose of executing works whereby a supply of water will be given in bulk outside the compulsory limits. A Bill promoted by the Runcorn Improvement Commissioners will provide for the purchase by that body of the undertaking of the Runcorn, Weston, and Halton Water Company, and the taking of an additional supply of water from the Liverpool Corporation. The pecuniary loss inflicted by the bursting of the Bradfield reservoir in 1864 still weighs on the Corporation of Sheffield, who are going to ask for a still further extension of the time during which the increased charge of 25 per cent. is leviable on the maximum water-rates authorized by the Sheffield Water-Works Act, 1853. An extension of time is also sought with regard to the period appointed for the construction of three reservoirs, one of which was sanctioned as far back as 1867. In the South of England, the proposals of the Bodmin Water Company are somewhat peculiar. The Company seek power to construct further works; and, as more capital will be required, Parliament is to be asked to authorize the Cornwall County Council to aid the Company by contributing money or taking shares. In West Hampshire there is a project for the incorporation of a Company for the supply of water to Christchurch, Sopley, Ringwood, Brockenhurst, Lyndhurst, and other places. The water is to be pumped from a well; and there is to be a service reservoir near the summit of St. Catherine's Hill, Christchurch. Provision is to be made in the Bill for the sale of the undertaking to the Christchurch Corporation. A Hampshire and Surrey scheme is represented by an application to be made for the incorporaton of a Company to construct works for the supply of water to Farnborough, Crondall, and Yateley, in Hampshire, and Frimley and Ash in Surrey. In Kent, the Corporation of Rochester give notice of a Bill, enabling them to acquire the undertakings of the Brompton, Chatham, Gillingham, and Rochester Water Company, and the Higham and Hundred of Hoo Water Company. On the other hand, the Chatham Corporation seek the necessary power to purchase the undertaking of the former Company, and to supply water in bulk to local authorities and others.

Something bearing closely on the water question, and relating to a Metropolitan suburb, occurs in the case of a scheme proposing the incorporation of a Joint Sewage Board for the districts of Staines, Chertsey, and other towns in the Thames Valley. The Board is to be authorized to construct pumping, precipitating, filtering, and other works for dealing with the sewage of the districts under its supervision, and for preventing the discharge of such sewage into the Thames "or its watershed." It is proposed that six of the London Water Companies (the Kent and the New River being exempt), shall pay to the Board an aggregate sum of £8000 per annum; and to the extent of their payments, three of the Companies—that is to say, the East London, Southwark and Vauxhall, and Lambeth—are to be exempted from further payment to the Chamberlain of the City of London under their respective Acts of 1886 and 1891. It is very desirable for all sewage to be kept out of the Thames; and Staines has long been a source of complaint, though there is no proof that it has in any way damaged the London Water Supply. But the Water Companies will assuredly object to be taxed for the sake of this sewage scheme, the title of which suggests an ominous recollection of the Lower Thames Valley Main Sewerage Board, and Sir Thomas Nelson's "Incredible Story."

Death of Mr. Hodgson Jones.—We regret to record the death, on the 1st inst., in his 70th year, of Mr. John Hodgson Jones. The deceased had been Consulting Engineer to the Continental Union Gas Company from its formation; and he had for many years filled a similar position in the Union des Gaz and the European and Oriental Gas Companies. He, however, practically retired from active work about twelve years ago. He had been unwell for some months, and went to Germany to take the waters; and he died at Kreuznach of apoplexy. Two of his sons—Mr. Layard and Mr. Walter Jones—manage the gas-works in Rome; and Mr. Charles Jones, the other son, those in Milan.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1009.)

THINGS have gone from bad to worse in the Stock Exchange; and all are plunged in "doleful dumps." There seems to be no turning to this long lane of doubt and depression which we have had to tread for months; and several disagreeable incidents in the past week have combined to render it still more remote. Briefly noted, they are the French Ministerial crisis, the Argentine financial difficulty, and the suspected unsoundness of a large financial undertaking. This state of doubt and uncertainty, and the prevailing dread of further troubles looming ahead, have necessarily thrown prices down. The Money Market remains practically in an unchanged condition, without any marked tendency either way, and without any indication of a change in the near future. The Gas Market has been only moderately active; and it continues very firm. Gaslight "A" has been pretty freely and steadily dealt in all the week, at precisely the same prices as in the preceding week; never ranging more than a point above or below 220. The renewed demand for high-class securities consequent upon the timidity with which the more speculative stocks are regarded, has shown itself in a free advance in the quotations of the preference issues, completely reversing the movement in the week before. Most of the Gaslight secured stocks were thus very brisk, and are higher in value. South Metropolitan were almost entirely stagnant, not being touched until nearly the close, when a few transactions in "B" and "C" were marked, at prices of which some were in excess of the nominal quotations. Commercials were rather more active; several parcels of the old stock changing hands at about average figures. The few transactions recorded among Suburban and Provincial Companies presented no particular feature; and all quotations remained unvaried. The Continental group were all very quiet; and prices did not change. Of the Indians, Oriental was firm, but Bombay was scarcely so well disposed. South Americans were irregular; Bahia being better on *ex div.* quotations; but Pará were a fraction weaker. The unclassed Ottoman—semi-Continental, semi-Oriental—also relapsed; and the isolated Malta did the same. Transactions in Water were not extensive; but the tendency to rise was well marked. A noteworthy feature is the fact that on Saturday the New River 4 per cent. debenture stock was bought at 135—a price which returns less than 3 per cent. for money, and which is equivalent to 2¾ per cent. Consols at 93.

The daily operations were: Gas opened quite unchanged, and remained quiet but steady all day at the old closing figures. In Water, East London rose 1; and Southwark ordinary 1½. Gas was no more active on Tuesday; but there was a disposition to buy the secured issues. Ottoman and Pará fell ¼ each. Business in Gas was rather more brisk on Wednesday; and preference stocks were in demand. Gaslight "C," "D," and "E" rose 1; ditto "J," 3½; and ditto "K," 1½. East London Water advanced another 1½. Prices on Thursday kept well up to the mark; quotations closing unchanged. The characteristic of Friday was very similiar; South Metropolitans being especially noticeable for good figures. Saturday was a little more active than usual, owing to the preferences being in request; and prices generally were firm and unchanged.

ELECTRIC LIGHTING MEMORANDA.

The Applications for Electric Lighting Orders—The Fortunes of the Swan United Company—Cheap Supply Units—A Mysterious Fire.

THE applications for Electric Lighting Orders show a great falling off as compared with any year since the passing of the Act of 1888; there being only fifteen in all, of which five relate to London, nine to towns in England and Wales, and one to Scotland. The Metropolitan districts referred to in these projects are Hackney, Hammersmith, and Islington; three schemes being proposed for the last-named populous region. A list of the provincial towns affected will be found elsewhere. The epidemic is evidently dying out; and unless something should occur to revive it, the specialists who have made such a good thing out of the victims will find their occupation gone. To change the figure, it may be said that the point of saturation for electric lighting has been very quickly reached in the United Kingdom, which is doubtless owing to the unsatisfactory results that have so far attended central station electric lighting in all but a very few instances. There is a large number of Orders in existence, upon paper; but we suspect that the majority are intended to remain a dead letter. It is not that there is a paucity of electric lighting work throughout the country; but local authorities are coming to see that people who want the light, and could afford a good rental, can supply themselves to greater advantage than they can buy current. The system of marking out selected areas for the compulsory service has gone a great way to show that the work is hardly worth doing. It means taxing a whole town for placing something which cannot be truly described as a necessary of life at the disposal of a few large tradesmen; and when it turns out, as is frequently the case, that in the small favoured district there are only a handful of probable] customers, any one of whom may make himself independent of the public supply by putting down a gas-engine and dynamo, it is not surprising the Orders should be hung up.

The tenth ordinary general meeting of the Swan United Electric Light Company, Limited, has been held; and a dividend after the rate of 10 per cent. for the year has been declared, with a balance of £6800 to the good. The title of this Company is a misnomer. It is called an electric light company; but no lighting is done—the business consisting partly of financing concessionary companies, and partly of the manufacture of lamps, in which there is a monopoly so far as this country is concerned. The patent will soon run out, however; and this coming event is casting an unmistakable shadow before it. Arrangements are in progress for fusing all the various Swan and Edison interests, which will cut down the financial work of the Board; and there will be no more patent litigation to occupy the attention of the management and swell the expenses of administration. The lamp manufacture will be carried on under strictly commercial conditions, as it is now in Germany. What the effect of competition in the trade is likely to be, in the estimation of the Board, is shown by their having written down the value of lamps in stock to 8d. each. If the result of this reduction in price, of which the public will reap the advantage in due time, should be to enable the Company to sell three lamps where they now sell one, they will be just as well off as they are now. On the other hand, if cheaper lamps mean for the public bad lamps, the expiry of the Swan monopoly will not be an altogether unmixed benefit to the community. An interesting sidelight was thrown upon modern commercial methods by the remarks of the Chairman (Mr. J. S. Forbes) with regard to platinum, of which the Company are large consumers. The Board were advised, by judges supposed to be competent, to lay in a heavy stock of this metal when it was worth 60s. an ounce, because all the indications pointed to still higher values; the production being limited, and controlled by a "ring," while the consumption was enormously increasing. They followed this advice, and now find themselves holders of a large quantity of the metal, while its price has actually dropped to one-half of what they paid for it. So difficult is it to gauge the movements of a market subject to these artificially-induced fluctuations.

In a recent number of the *Electrician*, some very good-looking figures are given to show how economically some of the London central electric lighting stations working under the direct low-pressure system are generating their current. It is stated that in the month of October (does this mean *for* the month?) at one of the stations of the Kensington and Knightsbridge Company, the total cost of "grinding out the current"—meaning probably the engine-room expenses—came out at 1·173d. per supply unit sold; the coal consumption being 5·9 lbs. per unit generated, or 6·4 lbs. per unit sold. It is expected that last month will show even better results for several of the stations, notably at some of those belonging to the Westminster Company, where the condensing plant has been recently set to work. This is very satisfactory; and it is quite right and proper that there should be a friendly rivalry in economy of working between the superintendents of engine-rooms devoted to generating and applying power in the same way and to similar purposes. It is evident that there is little more to be hoped for in regard to economical power generation, if it can now be done for considerably less than 1¼d. per unit sold. The great thing now will be to make a profit by selling for 7d. or 8d. what is produced at the ridiculously small cost already stated.

There was a fire a short time ago in a Regent Street shop, which the head of the London Fire Brigade has reported as having been caused by "overheat of electric wires." For this report Captain Simmonds has been roundly abused by an electrical journal, which has been unable to suggest any other reason for the mischance, but contends that a verdict of "not proven" ought to be entered when a fire cannot be brought home to electrical apparatus by something like ocular demonstration. The objection to this line of argument is that it is hardly to be expected that an electric lighting wire can be caught in the act of overheating itself. We have no wish to take away the character of electric lighting wires for harmlessness; but it may be asked, what proportion of the many cases of overheating actually gets to the length of such an outbreak of fire as brings the engines on the scene? Where the mischief can be taken in hand in time, no great harm is done. A little gutta-percha may have been frizzled, and some wooden casing charred; but there an end. The peculiarity of the Regent Street fire seems to have consisted in the fact of its originating in a closed shop window, ordinarily lighted by electric lamps which were actually shut off at the time. Consequently, there was not supposed to be any electricity on this part of the premises; and yet the window got alight, and the firemen ascribe it to the electric wires. Doubtless many theories might be framed to account for this very mysterious accident, and one is that "earthing" had something to do with it. It is a disturbing feature of these electrical conflagrations that they happen nobody knows how. If they could always be traced to a palpable leak, they would be more amenable to control than they can be while they retain their troublesome spontaneity.

HENRY M'LAUCHLAN BACKLER.

It is with much regret that we record the death on Wednesday last, at his residence at Champion Hill, S.E. of Mr. Henry M'Lauchlan Backler, for forty years one of the most prominent figures in the world of British and Foreign gas industry and finance.

Mr. Backler had been failing in health for some years, and was lately compelled to relinquish some of the heaviest of his administrative work; but his last illness was short, as he was in the City only ten days before his death. It is not too much to say that Mr. Backler created for himself, by unremitting industry, far-sighted prudence, and supreme probity, a position which was quite unique in the world in which he moved. Receiving his early education in Paris, he was as much at home in French as with his mother tongue; and he also possessed in a high degree rare gifts of intuition and sympathy, which were of great value to him in his business dealings with the authorities and people of different nationalities. Mr. Backler began his career in the gas industry in 1850, as Secretary of the European Gas Company, Limited, of which Company he eventually became Chairman and General Manager. He rendered special service to the Company during the Franco-Prussian War, by taking measures to secure the property of the Company; while the success of his financial policy was well shown by the position which the undertaking attained in his hands. Large bonuses were presented to the proprietors of this Company in 1874 and 1890; the opportunity of the last distribution being taken for the presentation to Mr. Backler of a testimonial in which the shareholders sought to express their high appreciation of his efforts on their behalf. Mr. Backler was also connected with the Continental Union Gas Company—first as an Auditor, next as a Director; being appointed on the Board in 1873. Two years later he was elected Chairman, which office he retained to the last. He was also Chairman of the Delegated Committee of the Union des Gaz. This Committee has the management of the various stations on the Continent of the Union des Gaz. Mr. Backler joined the Board of the Imperial Continental Gas Association in 1883, and resigned this position only a few months ago. He was also a Director of the Oriental Gas Company from 1875, and was elected Chairman in 1885.

Mr. Backler undertook nothing that he could not properly deal with. His daily attention to the work of the Companies over which he presided was remarkable; and he took exceptional pains to master personally every detail of their business. It was his boast that neither the European nor the Continental Union Company ever lost the supply of gas to a single municipality after it had once been confided to them; and if these Companies stand alone in this respect, it is a result due mainly to Mr. Backler's wise and conciliatory methods of treating all persons and interests with which he was brought into contact. Mr. Backler's popularity in France was shown by the fact of his having received the exceptional compliment of election on the Council of the Société Technique de l'Industrie du Gaz en France, of which he was the only foreign member.

His sense of justice and his kindly disposition, joined to unswerving integrity and a gentle, unassuming manner, won him the esteem and affection of all his associates and subordinates, who feel his death is a great loss, not only to the gas industry, but also to those who had so long looked up to him for a bright example and a helpful leader in the path of duty.

THE ROYAL SOCIETY.

The meeting of the Royal Society on Wednesday last has suggested some further observations in the public press respecting the position and working of scientific societies in the United Kingdom. The Royal Society is the chief of these; and it is little enough to say of the eminent men whose names adorn the membership roll of this national organization for the cultivation of science and the promulgation of scientific truth, that we are all proud of them. The Council of the Society act in a spirit of wise eclecticism in selecting recruits for their great companionship; and the fact that the ranks of gas, water, and sanitary engineers contribute a quota to this renowned body, makes the Royal Society the head of all those technical associations whose transactions form such a large proportion of the contents of this Journal. Indeed, when it is remembered how deeply indebted the Royal Society is to Count Rumford, whose memory it perpetuates by the Rumford Medal, it may be argued with much force that the connection of the Society is very close with the subjects to the study of which practical gas engineers and sanitarians are mainly devoted. A comparative glance at what was regarded as the proper work of the Royal Society in Count Rumford's day, and its work at the present time, will give us an epitome of the progress of the modern world in science and its applications. Count Rumford was of all workers most practical. The subjects of his labours were lamps, fire-grates, cooking and heating stoves, the ventilation of rooms—all sorts of actualities, in short, such as those which now occupy the attention of the order of technical workers for whom this Journal is mainly published. To take up the records of Count Rumford's labours, and trace out the modern developments of the branches of research in which he engaged, would be a deeply interesting and instructive task for any student of the engineering side of lighting, heating, cooking, and house ventilation. It is quite possible that such a study would be fruitful of new triumphs in the application of scientific principles to the satisfaction of the needs of civilised life; for the history of progress in material civilization is full of instances of threads dropped by the fathers being taken up again with advantage by their successors after long intervals. And it must be conceded that there is yet much to be done in all the matters to which Count Rumford addressed his remarkable genius.

From Count Rumford to Lord Kelvin is a long stride, in taking which we cover a whole epoch of such effervescing activity in the pursuit of science and the adaptation of its gains as the world never knew before. And what a difference we see in the constitution and objects of the Royal Society. At the first glance, an observer might be pardoned for concluding that all such homely studies as those which filled the mind of Count Rumford have vanished out of the ken of the transcendently clever gentlemen whom the Society now delights to honour. The principal subject of the Presidential Address, which the newspapers assume to be of necessity a kind of stock-taking of the scientific attainments of the year, was that of "terrestrial magnetic storms, and the hypothesis that they are due to magnetic waves emanating from the sun." There is not much of the stock-taking element in this discourse, which seems rather to be characterizable as Lord Kelvin's own essay in criticism of investigations into and observations upon a matter of capital contemporary interest to the scientific circle of which he is so conspicuous an ornament. And the awards of the medals at the disposal of the Society also serve to bring out the degree to which specialization in scientific activity is now carried. Thus the Rumford Medal itself was bestowed upon a Swede—Mr. Nils C. Dunér—"for his spectroscopic researches on stars;" while the Davy Medal went to Professor François Marie Raoult, "for his researches on the freezing-points of solutions, and on the vapour-pressures of solutions." A Royal Medal was also given to the Rev. Professor Pritchard, F.R.S., "for his work on photometry and stellar parallax."

These evidences of the change that has come over the working of the Royal Society since the era when it was regarded as a triumph of science for a Fellow of the Society to cook his dinner by the waste heat of the smoke from a neighbour's chimney, are worthy of notice as signs of the times. We all know what the respectable persons who delight in calling themselves "practical men" would say about disquisitions on the magnetic storms in the sun, even if they made no mention about the freezing-points and vapour-densities of solutions. The prototype of these practical men, who despise everything the immediate utility of which they are unable to perceive, was the "Merry Monarch," who, as recorded in Pepys's Diary, used to make especially merry over the devotions of the men of science of his day to such trivial experiments as "weighing the ayre," instead of paying attention to subjects which in his eminent judgment possessed more immediate importance. One might well wonder what science would have done for the world by this time if its professors had always directed their inquiries by the suggestions of such very practical men as Charles the Second. And how astonished the Clerk to His Majesty's Council would be, if he could be "materialized" among us, and induced to read a book describing only a few of the results of that trifling with "the weighing of ayre" by the philosophers of his time which so excited his own and his master's risibility!

There is another aspect of this matter, however, which the best friends of science must never overlook. Specialization in science and the arts is an unavoidable characteristic of the times in which we live. Count Rumford was, after all, like the master of an elementary school, who seems to know everything only because his knowledge of no particular subject is profound. In science, the era of the elementary school is past. Every individual student has to go through this stage of general instruction; but afterwards, if his ultimate position is to be anywise elevated, he must apply himself to the mastering, as far as his powers permit, of a specialty. And here is the opening for the manifestation of the "saving grace of common sense." After all is said that can be advanced on behalf of the claims of science, which is only a short name for exact truth, to men's study, irrespective of the immediate market value of its results, mankind in general will continue to watch and weigh jealously the risk of the absorption of the brightest intellects in unprofitable struggles with self-created puzzles. That there is this risk, nobody who has not succumbed to it will deny. It is hardly necessary to name examples of men of the highest powers of intellect who are now known as names only, because they did nothing to benefit either their contemporaries or successors, but spent their great endowments as it were in beating the air or in thrashing of chaff. Science must justify itself, after all, or it will be swept away like the school metaphysics that occupied its place in the Middle Ages. It is not for laymen to say how or in what directions Science shall "make herself useful;" but it is not the less understood that utility—taken in the broadest possible sense indeed, but still utility—is the justification of all true science. Humanity can produce nothing that is superior to itself; and until every need of mankind is satisfied, the pursuit of truth in the guise of science cannot be dissociated from its prime duty to serve in the true filial spirit the humanity from which it proceeds.

Keeping this motive for criticism in view, we are able to perceive that the Royal Society is not trifling, after all, with the needs of humanity, though it makes Count Rumford reward a stellar spectroscopist. We must form our standard of criticism in accordance with the spirit of the era in which we desire to apply it. In order to form an opinion as to whether science is barren or profitable, we must look at it all round, and take its representatives in their entirety. It would be a very imperfect judgment of Lord Kelvin that should proceed only upon the fact that he chose to address the Royal Society upon the subject of solar magnetic storms. He is the same who has prevented thousands of shipwrecks by improving the mariner's compass, and who recently invented a very practical kind of water-tap. Men who can do this variety of work have established a right to be as abstruse and recondite as they please on occasion; and when they reward a co-worker for doing something the value of which is beyond the understanding of the populace, nobody is likely to find fault with them.

Of all the good work that men like Lord Kelvin do, there is none worthier than that of the proof they exhibit that the connection between the highest science and the humblest service of mankind is as firm as ever it was, although it is not always so obvious as in the simpler time of Count Rumford. There is always danger lest pedantry should get the upper hand, and that only be esteemed scientific which is muddy, unintelligible, and spoken of in long words. So many men set up as scientific persons upon a capital of big-sounding expressions, and endeavour to mask the deficiencies of their education and the feebleness of their intellect by a more or less adroit employment of polysyllabic and foreign terminology. Lord Kelvin is not like this; nor is Tyndall, nor Huxley, nor Geikie, nor any other of the truly great and representative men of science whom happily we yet have among us, to say nothing of the illustrious dead whose renown the Royal Society rightly commemorates by means of its medals. The student who has once grasped the great truth that it is no more scientific to speak of a "circular orifice" than it is of a "round hole," is in a fair way to learn a good deal more.

It is not possible to conclude a notice of the Royal Society and its work without taking account of some of the criticisms which it receives; it being not more perfect than any other human institution. It is complained that the Royal Society is administered by, and mainly in the interest of, a clique, which results in a certain exclusiveness and tendency to run in grooves, from which it, of all organizations of the kind, ought to be free. The Council is alleged to be recruited from a somewhat limited area; and there are said to be certain "favoured persons, not always the most notable improvers of natural knowledge, who reappear upon the Council every five or six years." We should like to know of what voluntary society, scientific or otherwise, something of the same sort cannot be said after it has been in existence a few years? There will always be a few men who take more interest in managing any society than others do who are to all appearance equally eligible for office. Outsiders may express a real or an affected wonder at the non-appearance of certain names among the governing body; but nine times in ten there are reasons for the fact, albeit these may not be suitable for publication. Human nature is so constituted, moreover, that many members of a society who know it to be well managed, and have no desire to take part in the management themselves, are nevertheless ready to raise the cry of "favouritism" against the ruling authority.

It is asserted of the Royal Society, in certain quarters, that it is actually redolent of scholasticism; the professorial element abounding greatly to the exclusion of independent investigators. If this indictment of the Councils of the immediate past is justified by the facts, it is to be hoped that those of the future will take the criticism to heart, and open their ranks judiciously, so as to secure a sufficient flow of new blood of the right strain, without which any society must in time fall into decrepitude. It is not to be expected, however, that the Council of the Royal Society, any more than the administrative body of any other association, will ever succeed in managing their affairs to everybody's satisfaction. Clique or no clique—and it is remarkable how "cliquey" the party of discontent with an established system of administration commonly is—the great question for all societies and for the community interested in their welfare is, how the work of government is done. Does the society fulfil the object of its existence as well (say) as the average member fulfils his own duty in life? If not, and anybody can show how the shortcoming is to be supplied, then it is that person's duty to reform the institution. If there is no specific wrong to be redressed, complaints of imperfection are likely to be nothing more than grumbling; and the grumblers are usually the least efficient members of the communities or social organizations to which they belong.

Our American Correspondent.—We are pleased to announce that Mr. C. J. Russell Humphreys, Gas Engineer, Lawrence, Mass., has consented to act as Correspondent for the JOURNAL in the United States; and we hope hereafter to publish, at regular intervals, articles from his pen—dealing with gas and other cognate matters—in our "Essays" or "Communicated Articles" columns.

NOTES.

Elastic Foundations for Gas-Engines.

The desirability of mounting gas-engines and other motors used in town industries upon spring foundations having been mooted in *Industries*, as already mentioned in the JOURNAL (*ante*, p. 852), Mr. Robert H. Smith, of the Mason College, Birmingham, writes to that paper expressing his views on the subject. He remarks that all foundations are in some degree "springy," and that the really practical question is as to the amount of springiness to give to the foundation under stated conditions of working of the machine, and under what conditions it is desirable to make this springiness as nearly zero as we can get it. He goes on to narrate how a gas-engine in Birmingham was lately causing much annoyance by the vibration and noise it created in the building in which it was placed. An attempt was accordingly made to remedy the evil by mounting the wooden sole-plate that carried the engine and the dynamo driven by it, upon a dozen rubber pillarets 3 inches diameter and 4 or 5 inches high. The result was a failure; the oscillations of the engine bed-plate being excessively violent and irregular. Mr. Smith proceeds to discuss the nature and operation of the stresses tending to produce oscillations in a combined arrangement of gas-engine and dynamo; and he concludes that any solution of the difficulty must be of the nature of a compromise between the giving of annoyance by vibration and damaging the machinery by shaking. He recommends, in case a spring cushion and a massive brick, stone, or concrete foundation can be used in combination, the putting of the former underneath the latter, to the top of which the engine bed-plate should be bolted as hard and fast as possible. Of course, such a situation for the spring cushion would be a permanent one; and therefore rubber would not be a suitable material of which to make it, because its elasticity is soon lost under severe stress. If they could be secured from rotting, it might be supposed that a pitful of brushwood fascines would be the ideal spring cushion to put underneath a masonry engine foundation. Perhaps alternate layers of tarred felting and corrugated steel sheets would act well. A thick layer of felt is probably the cheapest. It may be remarked upon this that the durability of brushwood fascines might be prolonged by soaking in tar.

Silencing Gas and Steam Engine Exhausts.

M. Simon has communicated to *L'Electricien* a suggestion for reducing the noise of gas-engine exhausts. He points out that the noise is of two kinds. There is first a blow at every discharge; and, secondly, a distinctive note given out by the escape of the gases under pressure, which is always produced whether the exhaust is spasmodic or regular. As a matter of practice, the shock of the first can be mitigated by exhausting into chambers which play the same part as the air chambers of double-acting pumps. Unfortunately, this remedy is limited in application by the danger of filling large receivers with gases that may have escaped combustion in the cylinder, and thus compose an explosive mixture. Moreover, this method of regulation creates back pressure; and therefore, for two reasons, it is of limited applicability. M. Simon says that what is wanted is a gradual and insensible diminution of the average velocity of the exhaust gases. The variations of pressure, and consequently of volume, would thus be rendered very small, and the violence of the blows would be diminished; while the exhaust gases, having a lower velocity, would no longer give a loud note. A system of very acute-angled conical tubes has been tried by M. Simon himself and others, with the idea that the insensibly increasing cross section should produce a gradual diminution of velocity. Unfortunately, when the diameter approaches a certain value, the velocity of the gases is no longer equal over any given section, owing to the friction of the sides, which creates a series of vortices that make the tubes quiver, and so produces an effect the reverse of what is intended. M. Simon has substituted for these cones a single straight pipe, split for a distance of about 2 metres. The opening is very narrow at the bottom, and widens out until it attains a width equal to the diameter of the tube. The effect produced is remarkable when the right width for the cut has been hit upon; and this can only be done by the method of trial and error. It is no easy matter to split a tube in this way by means of ordinary tools, and alterations are a long and troublesome job. M. Simon has considerably simplified matters by giving the tube a long saw-cut lengthwise; the two halves being then opened out and kept apart by wedges and rings. From such an outlet the puff of exhaust gas spreads out like a fan, and the passage from the tube to the open air is very gradual. Such is the method, at once simple and cheap, which M. Simon has applied to his own satisfaction, and particularly to that of his neighbours, whose quiet was broken by his gas-engine. The same device will effectually reduce the noise of steam escaping from a pipe.

The Chemical Oxidation of Carbon.

The question whether pure carbon is known to science, and whether the various forms of matter that bear this name are not in reality modifications or compounds of pure carbon with other elements, has led to much examination of these forms. As reported in the *Monatschrift*, Herr J. Wiesner has subjected the various forms of carbon to the action of a mixture of sulphuric

acid and potassium dichromate, and observed under the microscope the changes produced by this treatment. The purest form of carbon he could procure was the charcoal derived from soot deposited from a gas-flame, heated successively in currents of chlorine, nitrogen, and hydrogen. This was found to be slowly attacked by the chromic mixture in the cold, and more quickly on warming. The action is much more rapid than with other varieties of carbon, owing to the finely-divided state of the material. Lignite appears under the microscope as brown transparent particles, which rapidly become colourless on treatment with the chromic mixture; leaving a skeleton tissue of cellulose. All the other varieties of carbon examined—coal, graphite, anthracite, cannel, &c.—contain a small quantity of an easily oxidizable substance which is quickly dissolved by the chromic mixture—leaving a residue which is only slowly attacked, no visible change taking place for weeks. Anthracite is seen by this method of examination to consist almost entirely of amorphous carbon, with a small quantity of a deep brown substance, which is slowly attacked by the oxidizing agent, but leaves no residue of cellulose. Bituminous coal behaves like a mixture of anthracite and lignite. Freshly prepared soot consists of fine black particles, which are hardly attacked by the acid, and partly of oily drops. The soot deposited from the atmosphere contains similar particles of carbon, which are sometimes united to form dendritic or irregular aggregates. The same thing occurs in the black pigment found in the human lung, which is merely soot that has been collected during life by the process of respiration.

Death of Mr. E. C. Peebles.—We learn, with regret, of the death of the eldest son of Mr. D. Bruce Peebles, of Edinburgh, which took place on his way to New York on the steamship *Teutonic*. Mr. Edward Clapham Peebles was a lad of high attainments and extraordinary promise; but about three years ago he was struck down by sickness, and had since been a great sufferer. The funeral took place at the Greenwood Cemetery, Brooklyn.

The Supply of Electro-Motive Force from the Coal-Fields.—At a recent meeting of the Manchester Association of Engineers, Mr. B. H. Thwaite read a paper in which he fully discussed the possibilities of the generation of electro-motive force in the coal-fields, and its application to industrial centres. The distribution of electrical energy for light and power, with fuel gas as the heating agent, would, he considered, go a long way towards clearing industrial centres from the depressing conditions which are so inimical to healthy vigour of mind and body. The author described three projects—one for supplying the Lancashire centres of industry and the area adjoining the Ship Canal; the second for serving the Yorkshire centres of industry; and the third for the Midlands and London. The paper was illustrated by a number of diagrams and figures.

The Flame Temperature of Water Gas.—An account of a series of experiments to determine the temperature of the flame of water gas is given by Mr. E. Blass, of Essen, in *Stahl und Eisen*. The instruments employed were Wyborgh's air pyrometer, Le Chatelier's electric pyrometer, Hartmann and Braun's telephonic pyrometer, and others by Siemens, Seeger, and Ducretel. It was found that Le Chatelier's formula for the variation of the specific heat of water vapour and other gases at high temperatures was practically reliable. The temperatures of combustion were taken for various proportions of air and gas, beginning with a large excess of the latter. With 0·18 cubic metre of air to 1 cubic metre of gas, the temperature was 425° C. Calculated according to the old formula, this would have been 521° C. Allowing for variation of specific heat, the theoretical value becomes 409°. For 0·714 cubic metre of air, the temperature was 1170°; and for the proportion of air just sufficient for combustion, the flame temperature was 1169°.

A Museum of Sanitary Appliances at Highgate.—The Highgate Museum of Sanitary Appliances will be opened by the Lord Mayor (the Right Hon. Stuart Knill) on Thursday next. This museum contains a valuable and instructive collection of modern sanitary appliances. It has been established by the Hornsey Local Board, who, some two years ago, conceived the idea of bringing together a few specimens of the most improved fittings for the guidance of builders and others in their district. With this object in view, a room with a floor-space of about 940 feet super. was erected; and manufacturers were invited to submit specimens of their sanitary goods. In order, however, to ensure the permanency of the museum, it was stipulated that all articles deposited should become the property of the Board. The advertising element has been carefully excluded. The principal manufacturers promptly and generously responded to the invitation; and it soon became necessary to provide more accommodation. The museum has gradually grown both in size and usefulness. It now consists of seven rooms, having a total floor-space of 4900 feet; and there are upwards of 1000 exhibits. Accommodation has been provided for the instruction of plumbers; and, in conjunction with the Worshipful Company of Plumbers (of which Company the Lord Mayor is Master for this year) and the Middlesex County Council, the Board are making arrangements for holding classes in plumbing under the direction of skilled teachers. It is also intended to inaugurate courses of instruction in sanitary science.

TECHNICAL RECORD.

THE GENERATION OF LIGHT FROM COAL GAS.

Professor Vivian B. Lewes's Cantor Lectures at the Society of Arts.

On Monday evening last week, Professor VIVIAN B. LEWES, F.I.C., F.C.S., Chief Gas Examiner to the Corporation of London, delivered his second Cantor Lecture on the above subject at the Society of Arts. It was devoted to a consideration of the labours of Frankland, Stein, Heumann, Soret, and Burch; and, as on the previous occasion, the lecturer's remarks were illustrated by experiments.

Leaving the brilliant work of Sir Humphry Davy and the lesser lights who followed in his wake, we come, said Professor Lewes, to the labours of another giant in our scientific world—one who is happily still with us, and whose work needs no posthumous halo to make it alike remarkable for power, brilliancy, and the wideness of its scope. Dr. Edward Frankland—whose researches were made first in the laboratories of Playfair, Bunsen, and Liebig, and afterwards at Queenwood, Owen's College, St. Bartholomew's, the Royal Institution, and the Royal College of Chemistry—left, in the same way that Davy did, his stamp on all he attempted. He threw his heart and soul into his researches; and he has given us a record of work which is remarkable for the way in which he has not only disclosed to us new facts, but has attempted in every case to discover the principles underlying them.

In August, 1859, Dr. Frankland, in company with Professor Tyndall, undertook an ascent of Mont Blanc, with the object of establishing thermometric stations between Chamounix and the summit of the mountain; and at the same time he took the opportunity of trying some experiments on the rates of combustion of candles at high altitudes, in order to verify the accuracy of a statement made by Le Conte that "the process of combustion is retarded by the diminution of the density of the air, while it is accelerated by its condensation." Burning six candles for one hour at Chamounix, Dr. Frankland carefully noted the loss of weight for each; and he repeated the experiment for a similar time on the summit of Mont Blanc. The average diminution in weight for each candle was 9·4 grammes per hour when burnt at Chamounix, and 9·2 grammes when burnt on top of the mountain. The close agreement of these results under such widely differing circumstances naturally suggested to his mind that the rate of burning of substances which require the oxygen of the air to support their combustion is entirely independent of the density of the atmosphere.

While he was watching the burning of the candles in the tent erected on the mountain, Dr. Frankland was struck by the small quantity of light they emitted, and by the way in which the non-luminous zone of the flame had extended its proportions to the detriment of the luminous zone. Later in the year he repeated these experiments under conditions which allowed of photometric measurement of the amount of light afforded by the candles under diminished pressure. The results are best given in his own words:—

> The result proved that a great reduction in illuminating effect ensues when a candle is transferred from air at the ordinary atmospheric pressure to rarefied air. At the same time, remarkable changes in appearance occur in the flame itself, especially at high degrees of rarefaction. During the diminution of pressure down to half an atmosphere, the chief alteration is the gradual invasion of the upper and luminous portion of the flame by the lower and non-luminous part. As the pressure sinks towards 10 inches of mercury, the retreat of the luminous portion of the flame towards the apex goes on uninterruptedly; but the shape and colour of the flame also begin to undergo very remarkable alterations. The summit becomes more and more rounded, until at 10 inches pressure the flame assumes nearly the form of an ellipse; while the blue portion, which now comprises nearly the whole flame, acquires a peculiar greenish tint. Finally, at 6 inches pressure, the last trace of yellow disappears from the summit of the flame; leaving the latter an almost perfect globe of the peculiar greenish-blue tint above mentioned. Just before the disappearance of the yellow portion of the flame, there comes into view a splendid halo of pinkish light; forming a shell half an inch thick around the greenish-blue nucleus, and thus greatly enlarging the dimensions of the visible flame. The colour of this luminous shell closely resembles that first noted by Gassiot in the stratified electrical discharge passing through a nearly vacuous tube, containing a minute trace of nitrogen. The colour thus imparted to the electrical discharge undoubtedly constitutes the most delicate test of the presence of nitrogen. In both cases I believe the coloured light to be due to incandescent nitrogen. In attempting photometrical determinations with candles, it was found that, owing to the irregularities of combustion, no satisfactory quantitative experiments could be made in artificially rarefied air. Oil-lamps also proved equally unsuitable, owing to the gradual ascent of the base of the flame towards the apex of the wick, by which the size of the flame and the hourly consumption of the oil were greatly diminished. Recourse was therefore had to coal gas, which, although liable to certain minor disturbing influences, yet yielded results, during an extensive series of experiments, exhibiting sufficient uniformity to render them worthy of confidence.

From the results of these experiments, Dr. Frankland deduced the following important law: "Of 100 units of light emitted by a gas-flame burning in air at a pressure of 30 inches of mercury, 5·1 units are extinguished by each diminution of one

mercurial inch of atmospheric pressure; or, more generally, the diminution in illuminating power is directly proportional to the diminution of atmospheric pressure."

As a natural sequence to these experiments, Dr. Frankland made a second series upon the effect of compressed air on the luminosity of similar flames, in regard to which he said:—

At the very outset of this part of the inquiry, considerable difficulties presented themselves, since it became necessary to abandon a gaseous combustible, which could not be compressed to the necessary degree, and then delivered at a uniform pressure through a burner, without very complex apparatus. I was thus compelled to resort to solid or liquid combustibles, the irregularities of which were still further increased by the space within the combustion chamber being necessarily more confined, in order that its walls might the better sustain high pressures. These difficulties in the way of accurate determinations, however, were by no means the most formidable; for it was soon found that any considerable increase of atmospheric pressure caused both candle and oil flames to throw off large quantities of fuliginous matter, the formation of which could not be prevented by any amount of draught that could be established in the chimney of the apparatus. Hence, although the luminosity of the flames was greatly increased, yet it was obviously much less so than would have been the case under conditions of more perfect combustion—in fact, it soon became evident that the determinations of increase of luminosity by compression must be made in a manner precisely the reverse of that employed for the corresponding determinations in rarefied air; for, while in the latter case the experiments were made with flames which, at ordinary atmospheric pressure, were saturated with luminous matter, in the former it was found necessary to commence with flames which were very feebly, or not at all, luminous at common pressures. Such is the effect of compressed air in determining the precipitation of carbon particles within the flame, that a small alcohol lamp, which at the ordinary pressure burnt with a pure blue flame, became highly luminous when placed under a pressure of four atmospheres; and it can scarcely be doubted that, at a pressure of five or six atmospheres, its luminosity would be equal to that of sperm oil burning at atmospheric pressure. Owing to these difficulties, I have only been able to obtain satisfactory determinations between one and two atmospheres. In these determinations, the lamp was supplied with amylic alcohol—a liquid which, while affording an appreciable amount of light in the experimental flame under a pressure of one atmosphere, was found to burn without smoke under two atmospheres, although at a somewhat higher pressure it began to evolve fuliginous matter.

The results of those experiments approximated, the lecturer thought, to those calculated from the law given for pressures less than that of the atmosphere; but when they were continued to still higher pressures, results were obtained which differed very widely from those that would have been expected.

In discussing the probable causes of these and other slight variations from the law, Dr. Frankland said:—

The luminosity of the flames generally used for artificial light emanates from two sources—viz., first from the ignition of minute particles of carbon floating in the shell of the flame; and, secondly, from the incandescence of gaseous matters. The latter source of illumination probably does not furnish more than 1 per cent. of the total amount of light; consequently, nearly the whole of the light given out by flame under ordinary circumstances is due, as Davy first pointed out, to the ignition of solid carbonaceous matter.

These statements, said Professor Lewes, showed that at that time—the year 1861—Dr. Frankland's views on the cause of luminosity in flame were in accord with Davy's; and he finally summed up the influence of atmospheric pressure upon combustion as follows:—

(1) The rate of burning of candles and other similar combustibles whose flames depend upon the volatilization and ignition of combustible matter in contact with atmospheric air is not perceptibly affected by the pressure of the supporting medium.
(2) The luminosity of ordinary flames depends upon the pressure of the supporting medium; and, between certain lights, the diminution in illuminating power is directly proportional to the diminution in atmospheric pressure.
(3) The variation in the illuminating power of flame by alterations in the pressure of the supporting medium depends chiefly, if not entirely, upon the ready access of atmospheric oxygen to, or its comparative exclusion from, the interior of the flame.
(4) Down to a certain minimum limit, the more rarefied the atmosphere in which flame burns, the more perfect is its combustion

It was in the month of June, 1861, that Dr. Frankland contributed these important observations to the Royal Society; and seven years later, he published a still more important communication in their proceedings—a paper in which he showed that flames like those of hydrogen or carbon monoxide in oxygen, which cannot possibly contain solid matter, can be made to emit light when burning under sufficiently high pressure. In this paper, which was read on June 11, 1868, he said:—

Further experiments made more than a year ago, on the nature of the luminous agent in a coal-gas flame, led me to doubt the correctness of the commonly-received theory first propounded by Sir Humphry Davy, that the light of a gas-flame, and of luminous flames in general, is due to the presence of solid particles. In reference to gas and candle flames, it is now well known that the fuliginous matter produced when a piece of wire gauze is depressed upon such flames, and the sooty deposit which coats a piece of white porcelain placed in a similar position, are not pure carbon, but contain hydrogen, which is only completely got rid of by prolonged exposure to a white heat in an atmosphere of chlorine. On pursuing the subject further, I found that there are many flames possessing a high degree of luminosity which cannot possibly contain solid particles. Thus the flame of metal arsenic, burning in oxygen, emits a remarkably intense white light; and as metal arsenic volatilizes at 180°C., and its product of combustion—arsenious anhydride—at 218°C., while the temperature of incandescence of solids is at least 500°C., it is obviously impossible here to assume the presence of ignited solid particles in the flame. Again, if carbonic disulphide vapour be made to burn in oxygen, or oxygen in carbonic disulphide vapour, an almost insupportably brilliant light is the result. Now, fuliginous matter is never present in any part of this flame; and the boiling-point of sulphur—440°C.—is below the temperature of incandescence. So that the assumption of solid particles in the flame is here also inadmissible. If the last experiment be varied by the substitution of nitric oxide gas for oxygen, the result is still the same; and the dazzling light produced by the combustion of these compounds is also so rich in the more refrangible rays, that it has been employed in taking instantaneous photographs, and for exhibiting the phenomena of fluorescence.

Many other cases of the production of brilliant light from incandescent gaseous or vaporous matter might be cited; but I will mention only one other. Amongst the chemical reactions celebrated for the production of dazzling light, there are few which surpass the active combustion of phosphorus in oxygen. Now, phosphoric anhydride, the product of this combustion, is volatile at a red heat; and it is therefore manifestly impossible that this substance should exist in the solid form at the temperature of the phosphorus flame, which far transcends the melting-point of platinum. For these reasons, I consider that incandescent particles of carbon are not the source of light in gas and candle flames, but that the luminosity of these flames is due to radiations from dense, but transparent hydrocarbon vapours. As a further generalization from the experiment above mentioned, I was led to the conclusion that dense gases and vapours become luminous at much lower temperatures than aëriform fluids of comparatively low specific gravity; and that this result is to a great extent, if not altogether, independent of the nature of the gas or vapour, inasmuch as I found that gases of low density, which are not luminous at a given temperature when burnt under common atmospheric pressure, become so when they are simultaneously compressed. Thus mixtures of hydrogen and carbonic oxide with oxygen emit but little light when they are burnt or exploded in free air, but exhibit intense luminosity when exploded in closed glass vessels, so as to prevent their expansion at the moment of combustion.

I have recently extended these experiments to the combustion of jets of hydrogen and carbonic oxide in oxygen under a pressure gradually increasing to 20 atmospheres. These experiments were conducted in a strong iron vessel, furnished with a thick plate of glass of sufficient size to permit of the optical examination of the flame. The results are so remarkable that, although still far from being complete, I will venture to communicate them to the Royal Society before the close of the session. The appearance of a jet of hydrogen burning in oxygen under the ordinary atmospheric pressure is too well known to need description. On increasing the pressure to 2 atmospheres, the previously feeble luminosity is very visibly augmented; while at a pressure of 10 atmospheres, the light omitted by a jet about an inch long is amply sufficient to enable the observer to read a newspaper at a distance of 2 feet from the flame, and this without any reflecting surface behind the flame. Examined by the spectroscope, the spectrum of this flame is bright, and perfectly continuous from red to violet. With a higher initial luminosity, the flame of carbonic oxide in oxygen becomes much more luminous at a pressure of 10 atmospheres than a flame of hydrogen of the same size, and burning under the same pressure. The spectrum of carbonic oxide burning in air is well known to be continuous. Burnt in oxygen under a pressure of 14 atmospheres, the spectrum of the flame is very brilliant, and perfectly continuous.

This paper, continued the lecturer, striking as it did at the root of the fundamental ideas existing as to the causes of luminosity in flame, produced a profound sensation; and it was not long before the interest taken in it was made manifest by criticisms and attacks upon the new theory put forward. One of the first of these was by W. Stein, who, in criticizing in the *Journal für Practische Chemie* the various points in Dr. Frankland's paper with regard to the observation that the soot deposited from a luminous flame is not pure carbon, but contains hydrogen, made the following remarks:—

The first objection to this is that, as is well known, not only do all heavy hydrocarbons decompose with deposition of carbon, at a high temperature in absence of air, but even marsh gas itself. Since now the hydrocarbons whose vapours are supposed to produce the luminosity are under such conditions before they are reached by the oxygen of the air, it cannot be doubted that they must undergo a decomposition, in the luminous part of flame, into carbon and hydrogen. Whether the separated carbon is chemically pure, or whether it is mixed with a body containing hydrogen, is of slight importance, since the chief question with which we are concerned is whether the soot is present in the flame as vapour or in the solid state. If it were a conglomeration of the densest light-producing hydrocarbons, whose vapours condense on the cold body, then it must, when strongly enough heated in absence of air, again be vaporized. This, however, is not the case, as every one will find who tries the experiment. Moreover, its chemical composition is just as little favourable to Frankland's view. This will presumably vary according to the different luminous material from which the soot is obtained, and also according to the position in the flame from which it is taken. For the temperature of flames is, as is well known, different at different points; and, as is known from the researches of Magnus, at lower temperatures, in addition to hydrocarbon, a tarry product containing hydrogen separates from the hydrocarbon. The soot of which I give an analysis below was collected from a gas-flame by sinking the bottom of a small silver kettle filled with water from 2 to 3 mm. deep into the flame. Benzene extracted from it traces of a solid yellow body, which, on account of its small quantity, could not be further examined. Nothing was extracted by alcohol, alcoholic potash, and dilute sulphuric acid. After careful and continued washing with boiling water, and drying at 130°C.,

0·296 gramme of the soot gave 0·6985 carbonic acid, 0·0195 water, 0·0020 ash. This amounts to—

		Or in Ash-Free Substance.
Carbon	96·446 per cent.	97·390 per cent.
Hydrogen	1·051 „	1·061 „
Ash	0·970 „	—
Oxygen	1·533 „	1·549 „

The oxygen which it contains must, I think, be ascribed to a small quantity of water being left in it, even after drying at 130°. If this be deducted, then the water and ash-free substance consist of 99·095 per cent. of carbon and 0·905 per cent. of hydrogen. This analysis consequently confirms that view of the chemical composition of the soot of flames which is based on the known behaviour of hydrocarbons at high temperatures. . . . In order to show that his view of the luminosity of vapour is not without examples, Frankland points to the luminosity which takes place on burning arsenic, phosphorus, and carbon bisulphide in oxygen gas at the ordinary pressure, and hydrogen and carbonic oxide at an increased pressure, since in these cases the co-operation of solid particles cannot come in question. However valuable and interesting this all may be from a scientific point of view, it does not in any way prove that the process in our luminous flames must be an analogous one, since the well-established fact that solid bodies are specially adapted for becoming radiant is not altered by it; and up to the present only one solid body has been discovered to which one could ascribe the luminosity of these flames. When, therefore, all that has been stated is considered, no other conclusion can be arrived at but that the light of our luminous flames comes from incandescent particles of carbon, and that therefore the old view is the true one.

Professor Lewes next referred to the researches of Knapp, who about this time showed that the luminosity of a coal-gas flame could be destroyed not only by admitting air, as in the Bunsen burner, which had been supposed to destroy luminosity by the more rapid combustion of the carbon particles, but also by burning the coal gas with inert gases such as nitrogen and carbon dioxide, which could not take part in the combustion—a phenomenon explained by Wibel as being due to the cooling effect of these gases upon the flame, as luminosity may be restored by heating the mixture of gases just before combustion. These views were criticized by Dr. Karl Heumann in Liebig's *Annalen* (Vols. CLXXXI. and CLXXXII.), as well as Dr. Frankland's work, concerning which he made the following remarks:—

Frankland has broached the hypothesis that the luminosity of flame is not due to particles of suspended carbon, but is caused by the vapours of heavy hydrocarbons which radiate white light. Strong, positive evidence in support of a view so much at variance with the generally accepted theory could hardly be expected; and Frankland has relied principally upon the fact that we are acquainted with many luminous flames in which we cannot suppose that solid matter is present. To the instances already known, Frankland has added the interesting observation that hydrogen and carbon monoxide, when burned in oxygen under a pressure of 10 to 20 atmospheres, yield a luminous flame affording a continuous spectrum, and also that the faintly-luminous flame of alcohol becomes as bright as that of a candle when the pressure is increased to 18 or 20 atmospheres. These experiments are not so convincing as might at first sight appear, inasmuch as we know that the temperature of the flame is increased at high pressures; and also that, at the temperature of the electric spark, many gases yield a continuous, in place of a line spectrum. The power of gases as regards emission of light also varies considerably under these circumstances; and it does not appear that we are absolutely necessitated, as Frankland has supposed, to ascribe the increase in luminosity to the increased density of the gas, although doubtless this circumstance is not without considerable influence. The inquiry as to the nature of hydrocarbon flames is quite independent of the meaning which we may attach to these appearances; and if Frankland puts forward the above-cited phenomena of combustion as analogies to guide him in views concerning carbon flames, no very forcible argument can be really deduced from the examples, because, as Stein has pointed out, it cannot be shown that the reaction in luminous carbonaceous flames *must* be an analogous one to that described above. Frankland's declaration that the soot must be regarded as an accumulation of heavy hydrocarbons whose vapours are condensed on the cold body brought into the flame, may be regarded as almost confuted by Stein's objection that in this case the soot must become gaseous at higher temperatures, which is not the case.

Going on to Wibel's conclusions, Heumann pointed out that every-day experience showed that the blue flame of the Bunsen burner, as well as that of the blowpipe, possesses a much higher temperature than the ordinary luminous flame; but that if Wibel were correct in saying that decrease in luminosity is a consequence of cooling only, then logically the temperature of the luminous flame ought to be higher than that of the non-luminous flame. He then attacked the various problems to which the Bunsen flame gives rise, and finally came to the conclusion that, when air destroys the luminosity of a coal-gas flame, there are at least three causes, each of which is capable of decreasing the luminosity of these flames—viz., withdrawal of heat, dilution, and oxidation of the luminous material. In most cases, said Professor Lewes, two or more of these causes are at work. In non-luminosity brought about by nitrogen and carbon dioxide, especially dilution and heat absorption, in the widening out of a flame caused by a cold surface absorption of the heat, and a more rapid oxidation of the carbon, and in non-luminosity caused by air, one of the three causes is at work. The flame of a Bunsen burner appears to be the final product of a whole series of causes—some acting in one direction, some in another; and it is not to be wondered at that observers of luminous flames have arrived at such diverse and contradictory conclusions, inasmuch as they have made the study of this flame their principal object, overlooking the great complexity of the conditions affecting it, instead of preceding such a study by an investigation of more simple instances of combustion.

After fully discussing the effect of cooling upon combustion in flames, Heumann came to the following very important conclusions:—

(1) The fact that a gas-flame does not rest upon the burner, nor a candle-flame upon the wick, as also the fact that a flame never directly touches a cold body held within it, is to be explained by the cooling action exercised upon the gas by its surroundings. When the combustible gases are cooled throughout a definite space below their ignition temperature, the flame is extinguished.

(2) The very considerable distance noticed between the burner and the flame of a gas issuing under high pressure, or mixed with a large volume of an indifferent gas, is to be traced to the cooling action of the stream of gas and of the outer air, and perhaps more especially to the fact that the velocity of the stream of gas in the neighbourhood of the burner is greater than the velocity of propagation of ignition within the gas.

The lecturer went on to say that, in a second paper published in the *Annalen* (Vol. CLXXXIII.), "On the Influence of Withdrawal of Heat from, and Addition of Heat to, Luminous Flames," several interesting points were discussed by Heumann, who came to the following conclusions:—

A cold object brought into a luminous flame causes a suspension of the process of combustion in its immediate neighbourhood, and at the same time very materially diminishes the luminosity throughout a considerable space around itself. Carbon-containing luminous materials may burn with or without separation of carbon—that is, with or without luminous flames—according as a certain temperature, differing for each material, is or is not maintained. Combustible material which has been diluted with indifferent gases requires to be maintained at a higher temperature, in order that it shall burn with a luminous flame, than when it is not so diluted. The fact that soot is deposited on a cold object held in a luminous flame is no proof of decreased temperature within the flame, inasmuch as it has been shown that decreased temperature causes a diminution in the quantity, or even total suppression, of the separated carbon. Soot is also deposited on heated surfaces, but is quickly burned on admission of air. Inasmuch as admission of air cannot be altogether prevented, less soot is accumulated on hot than on cold objects.

Burners constructed of iron or other material possessed of high conductivity for heat cause a greater diminution in the luminosity of the lower part of the flame than burners of steatite. The difference between the luminosities of the two flames is rendered more apparent by artificially cooling the burner. The top of the burner and the entering cold gas both exert a cooling action upon the lower part of the flame, and are the cause of the space noticeable between the burner and the flame-mantle. By heating the burner and simultaneously the stream of gas, a more luminous flame is obtained without an increased consumption of gas; the increase in luminosity being greater, the smaller the consumption of gas. The change which is hereby caused in the chemical composition of the gas is without appreciable effect upon the luminosity, inasmuch as no diminution in luminosity is occasioned by again cooling the stream of gas. The heat communicated by increasing the temperature of the burner-tube acts in two ways—it increases the intensity of the light of the flame-mantle, and simultaneously enlarges the flame itself. Carbon is also sooner separated in the flame, and separated at a higher temperature.

Heumann's most valuable contribution to the question of whether or not luminous hydrocarbon flames contain solid particles is to be found in Vol. CLXXXIV. of the *Annalen*, which he sums up as follows:—

(1) Chlorine causes an increase in the luminosity of feebly-luminous or non-luminous hydrocarbon flames. Inasmuch as chlorine decomposes hydrocarbons at a red heat, with separation of carbon, it follows that the increased luminosity is due to the production of solid carbon particles.

(2) A small rod held in the luminous flame becomes rapidly covered on its lower surface—the surface opposed to the issuing gas—with a deposit of soot. The solid soot is evidently driven against the rod. If the soot were present as vapour in the luminous flame, its deposition would be due to a lowering of the flame temperature, and would therefore take place on all sides of the rod.

(3) A strongly-heated furnace also becomes covered with a deposit of soot. This would not be possible if the deposit were the result of the cooling action of the surface upon the flame.

(4) The carbon particles present in the luminous flame become visible when the flame is caused to rush against another flame, or against a heated surface. The separated particles are rolled together into larger masses, so that the luminous mantle becomes filled with numerous glowing points. The soot of such a flame is very cross-grained.

(5) The luminous mantle of a flame is not altogether transparent. The thicker the flame-layer, and the greater the number of solid particles contained therein, the less transparent does it become. The transparency of a luminous flame is no greater than that of the (approximately) equally thick stratum of soot which rises from the flame of burning turpentine, and which is universally allowed to contain many solid particles. A luminous flame of hydrogen, containing solid chromic oxide, is as transparent as the hydrocarbon flame.

(6) Those flames which undoubtedly owe their luminosity to the presence of finely-divided solid matter, produce characteristic shadows when viewed in sunlight. The only luminous flames which do not produce true shadows are those which consist of glowing vapours and gases. Luminous hydrocarbons produce strongly-marked shadows in sunlight, these flames,

therefore, contain finely-divided solid matter. That this solid matter can be nothing but carbon is evident from the fact that other substances, capable of remaining solid at the temperature of these flames, are absent.

These proofs are, I think, sufficient to convince everyone that the luminous flames of hydrocarbons actually contain solid carbon particles.

This splendid contribution to the carbon-particle theory of luminosity in hydrocarbon flames, said Professor Lewes, was further strengthened by researches made by Soret, who showed the existence of solid particles in a luminous hydrocarbon flame by focussing the sun's rays upon the luminous portion of the flame, and examining the light reflected by it with the help of a Nicol prism. Burch also, in 1885, did the same thing in a very similar way. While demonstrating to his landlady that the sun's rays did not extinguish the fire, but only prevented the heat from being seen, he was struck by the power of the sunlight in overcoming the light emitted by even highly-incandescent bodies; and he found that, on focussing the sun's rays on a flame, a spot of light was visible on the luminous mantle of the flame, and the reflected light from this gave ample evidence, when examined by the spectroscope, of the presence of solid particles. Quite lately, Sir George Stokes had also come to the same conclusion by experiments of a similar character.

I have this evening, said the lecturer, in conclusion, brought before you the one celebrated attack upon Davy's theory, and the further evidence which it brought forth; and I confess that, to my mind, the facts are so overwhelmingly in favour of Sir Humphry Davy's original assumption as to the cause of luminosity in hydrocarbon flames, that, although Dr. Frankland undoubtedly showed that solid matter was not a necessity for a luminous flame, yet that, in the special class of flames we are considering, the light-giving power is practically entirely dependent on their presence. It must, however, be borne in mind that Dr. Frankland himself is in no way shaken in his opinion; and we may all hope to hear further proof of his theory. While the physical aspects of luminosity were being studied in this way, there had not been wanting attempts to attack the question from a chemical point of view; and the researches of Dr. Hilgard, Landolt, and Blochmann have done much towards enlightening us as to the chemical changes taking place in hydrocarbon flames. But as the facts demonstrated by their work fit in best with the theories I shall have to bring before you next week, a discussion of their results will be better reserved until then.

Disposing of the Exhaust from Gas-Engines.—The difficulty at present experienced in disposing of the exhaust from gas-engines without either causing a nuisance in the neighbourhood of the engine, or wasting power in driving the exhaust upwards, has, we understand, been overcome in a very simple manner, by Mr. A. Paton, of Beeston Hill, Leeds. His contrivance consists in the use of a double exhaust-pipe, so arranged that a circulation of air is automatically caused in it; and thus the exhaust passes up quietly without absorbing any engine power.

Pintsch Gas v. Oil-Lamps.—Professor J. E. Denton, of the Stevens Institute of Technology, has been making thorough experiments to test the candle power of Pintsch gas and of oil-lamps. The substance of the report shows that the former is capable of affording an illumination of 40-candle power, continuously, in an ordinary flat-flame lamp, without requiring anything more than the usual attention to lamps by railroad employees; whereas the latest improved Argand burners with oil cannot be made to give more than 16 candles per burner, and with the best form of flat-flame double-wick lamps not more than 8 candles per burner. This, says the *Railroad Gazette*, gives an average of 2½ to 5 times more illumination by the gas than by the oil; and the tests further show that the heat generated from the oil is 50 per cent. greater than that from the Pintsch gas.

Death of Mrs. Sellers.—We regret to record the death, on the 26th ult., of Mrs. Mary Sellers, mother of Mr. Charles Sellers, the Engineer and Secretary of the York Gas Company. The name of Mrs. Sellers has frequently come before our readers in connection with the Christmas and other social gatherings at the York Gas-Works, with which it was always a pleasure to her to be associated. She at all times took a deep interest in the welfare of the workmen and their families; and she was personally known to, and held in high esteem by, the whole of the employees. Her gifts of toys to their children were, it may be remembered, a specially interesting feature on the occasions of Mr. Sellers's Christmas addresses. To a wide circle of friends she presented a character of more than ordinary attractions. She had uniformly good health, and a most generous disposition; and she passed through a long life grateful for the advantages she possessed, and always ready to rejoice in the prosperity of others. The deceased lady was in her 91st year, and had resided in York for about half a century. The interment took place last Tuesday at Fridaythorpe, where Mrs. Sellers resided prior to taking up her abode in York. Upwards of 200 of the workpeople and officials of the Gas Company assembled at the residence of the deceased, and deposited wreaths upon the coffin; and they accompanied the funeral procession for some distance.

MANCHESTER DISTRICT INSTITUTION OF GAS ENGINEERS.

In the JOURNAL last Tuesday, we gave a report of the formal business at the ninety-second quarterly meeting of the above Institution, held at Manchester on the preceding Saturday, together with the text of the papers read by Mr. Harrison Veevers, on "The Use of Oxygen in the Purification of Coal Gas," and by Mr. W. R. Chester, giving "An Account of a Recent Explosion in a Tar Well." To-day we complete the report by publishing the discussions which followed the papers.

THE USE OF OXYGEN IN THE PURIFICATION OF COAL GAS.

At the conclusion of the paper read by Mr. Veevers,

The PRESIDENT (Mr. C. Armitage, of Lancaster) remarked that it dealt with a very important subject, and would he hoped lead to a good discussion.

Mr. W. R. CHESTER (Nottingham) said the congratulations of the members were due to Mr. Veevers for bringing forward for discussion a subject which was exceedingly interesting, and with which they had hitherto not had sufficient opportunity to deal. In the introduction of any new thing, Mr. Veevers was always in the forefront; but the question of how far he was wise or otherwise in adopting this particular method of purification remained to be seen. They would all agree with Mr. Veevers that the time had arrived to make some alteration in his purifying plant, when it became a necessity to change ten boxes a week. Any change under the circumstances could hardly be for the worse. He regretted, however, there was in connection with the paper such an absence of statistical information of working results as would make it difficult for them to form any clear conclusion as to the merits of the system. In consequence of this, it would be necessary to assume certain figures, in order to effect a comparison. Mr. Veevers laid it down that the relative proportions of purifying plant under the old and new system he had adopted were as 100 to 53 in area—*i.e.*, where it was necessary under the old system to have six 18 feet square purifiers, he could effect his purification with oxygen with four purifiers 16 feet square.

Mr. T. B. BALL (Rochdale) pointed out that the four new purifiers put down by Mr. Veevers were 18 feet square.

Mr. CHESTER said that was so much the worse from his point of view. If the new purifiers were 18 feet square, the relative proportions of purifying area stood as 3 to 2, instead of about 2 to 1. Now let them see what the cost of an installation of purifiers was, to effect complete purification, dealing with carbonic acid, sulphuretted hydrogen, and the sulphur compounds, and not merely with the one impurity—sulphuretted hydrogen—Mr. Veevers dealt with. In his own works, he had recently put down purifiers for complete purification; and he so arranged them that they should have a total area of 1·5 square feet per 1000 cubic feet of gas maximum make per day. The cost for this area including everything worked out to 45s., or 30s. per superficial foot. The interest at 5 per cent. on a capital outlay of 45s. was 2s. 3d. per annum; and assuming the annual output to be 200 times the maximum daily make, the cost per 1000 cubic feet of gas purified, for interest alone, would be $\frac{2}{200}$ of 2s. 3d., or 0·135d. per 1000 cubic feet. Again, taking his own case, he found the cost for labour, in connection with purification, worked out to 0·265d. per 1000 cubic feet; and it should be borne in mind that this was not the mere cost for sulphuretted hydrogen removal, which was usually done for about one-half that figure, but was the cost for complete purification. Now it was in these two figures he took it that, if there was any economy in the oxygen process of purification, it must be looked for. He knew there were certain other economies alleged—such as the saving in the matter of purifying material, and the increase in the illuminating power of the gas. But as they were, in his opinion, both insignificant, and both problematical, he left them out of the comparison altogether. The total cost for interest and labour under adverse circumstances, as compared with Mr. Veevers's requirements, was 0·135d. and 0·265d. respectively, or 0·4d. per 1000 cubic feet. Mr. Veevers did not, however, pretend that he saved all this. In interest on capital outlay, he saved one-third; and in labour he was not quite sure to what extent the saving might be counted upon. But, for the purpose of comparison, he (Mr. Chester) took it that Mr. Veevers saved one-half the cost of interest, and one-half the cost of labour; and the total saving due to the oxygen system would thus be 0·2d. per 1000 cubic feet of gas purified. The next thing they had to see was what this economy cost to effect. He would assume the oxygen to cost 5s. per 1000 cubic feet. Mr. Veevers did not give the cost; but if he (Mr. Chester) had taken too high a figure, he was open to correction, and prepared to modify his calculation accordingly. Mr. Veevers told them he used 1 per cent. of oxygen, or equal to 10 cubic feet per 1000 feet of gas purified; but 10 cubic feet, at 5s. per 1000, was 0·6d.—*i.e.*, the cost of the oxygen alone which he used was 50 per cent. higher than the total cost of purification for labour and interest at Nottingham. To sum up, it looked as though, by the oxygen process, Mr. Veevers had succeeded in effecting an economy of 2d. by saddling himself with a perpetual additional cost of 6d. per ton of coal carbonized. Oxygen purification had a very fascinating influence, both from a chemically scientific point of view and from the fact that, by it, they approached more nearly

the ideal of purification in closed vessels. Yet, in spite of these allurements, it was the commercial element which must ultimately determine its success or otherwise in the purification of coal gas.

Mr. Isaac Carr (Widnes) thought Mr. Veevers was discreet in asking them, before he read his paper, to look over any shortcomings which there might be in it; for he (Mr. Carr) had never listened to any paper which was more indefinite. Mr. Veevers told them he was perfectly satisfied that this process was the best to adopt; but he left them in the dark as to what led him to this conclusion. There were several remarks in the paper on which they could found assumptions; but the paper itself gave them no data at all. What most astonished him was the statement about changing ten purifying-boxes in a week. Mr. Veevers's make was from 50 million to 60 million cubic feet per annum; and his maximum weekly production would not greatly exceed 2 million feet—and this gave an average of only 200,000 feet per box. All he could say upon this was that there must have been something radically wrong; the oxide must have been very bad, or in bad condition, to yield such wretched results. A change of one or two boxes a week should be abundant if the oxide was good; for boxes of that capacity—that is, 16 feet square—and at the stated rate of make, ought to pass a million cubic feet of gas without any difficulty. As to the working of the oxygen process, Mr. Veevers did not tell them what it cost in the aggregate to purify his gas before he introduced the process, nor did he tell them what it cost to do it now. The explanation was that he had not had time. Well, all he could say was that it must be a very complex matter; because, when a paper was read by Mr. Stenhouse on the same subject three months since at Rochdale, the question was asked, and the information was not given for some reason. In the absence of anything more definite, he had made a little calculation as to how the process would affect him at Widnes. At present, to take out the sulphuretted hydrogen, carbonic acid, and sulphur compounds, the cost, including everything, was 0·4d. per 1000 cubic feet. Out of this item, the cost of labour for revivifying the oxide was only 0·15d. The annual make at Widnes was 140 million cubic feet; and the cost of the labour, at 0·15d., worked out to £87 10s. per annum. Of course, if they had not to change the purifiers, they would also save the gas which was lost at each change. They changed about one hundred boxes, each 20 feet square; and, reckoning the loss of gas at 3000 feet at every change, and the cost of the gas at 1s. per 1000 feet—which was about the cost without the standing charges—the saving under this head would be £15. Therefore, by adopting the Brin process, they would save a little more than £100 a year at Widnes. But to save the £100, they would have to use 1 per cent. of oxygen, at (say) 5s. per 1000 cubic feet, that would cost £350 per annum, or 0·6d. per 1000 cubic feet of gas purified. In other words, to save 6d., they would have to spend 1s. 6d. If he were wrong in his calculation, he should be very glad if the gentlemen who had the process in hand would set him right. It was stated by Mr. Valon, in the paper he read before The Gas Institute in 1888 that oxygen cost 5s. per 1000 feet; but he (Mr. Valon) further stated that even if it cost 15s. there would still be a large margin of profit. This statement increased his (Mr. Carr's) difficulty of understanding the commercial value of the process, because, if oxygen cost 15s. per 1000 feet, the outlay at Widnes to provide 1 per cent. would be £1050 per annum, or 1·8d. per 1000 cubic feet of gas purified, for oxygen alone. The advantages which Mr. Veevers claimed for the process were rather small. It was a benefit no doubt to be rid of the nuisance of changing the boxes, and to be able to make the oxide do more work; but these advantages were too small to be considered in comparison with the extra outlay.

Mr. J. Braddock (Radcliffe) remarked that Mr. Veevers had brought a very important subject before their notice, and good would no doubt result from the paper and the discussion upon it. He agreed with Mr. Veevers that purification of gas from sulphuretted hydrogen required an undue proportion of space, capital, and working expenses. On the general question of Oxygen *v.* Air, the former was unquestionably to be preferred, if oxygen could be obtained at a reasonable rate. It was, in fact, a thoroughly scientific application to a specific purpose. He should like, by the way, to give a word of warning to those who were trying the air process, of the extreme caution which was required to prevent the firing of the oxide in the purifiers, particularly in the summer time, when temperatures were high, and the oxide was charged with sulphur. He had had an unpleasant experience of this kind; and those who had had one would not want a repetition of it. Coming to the paper, he did not think Mr. Veevers would shrink from adverse criticism, though there were circumstances which should induce them to be lenient with him. It certainly did seem to him an excessive thing to change ten purifiers a week. He formerly allowed a 16-feet box to purify a million feet of gas, using three out of the four; and he should certainly say that this number and size of boxes would be ample for 750,000 cubic feet. He could not, therefore, understand why at Dukinfield, with its limited make of gas per annum, it should be necessary to change more than three or four boxes during a week. It seemed to him that either there must have been an excessive percentage of sulphuretted hydrogen at the inlet to the purifiers, or there was not sufficient active oxide in the boxes. Another point which occurred to him was with reference to the loss of gas on changing the purifiers. He failed to see how the admission of 1000 feet of gas into the purifiers to expel the air entailed a loss of 2000 feet of gas. It appeared to him that in this case Mr. Veevers had counted the loss twice over. The paper was not, and did not profess to be, a complete review of the subject. Still it was a valuable contribution to the literature on the matter, and would, he believed, do something to hasten the time when they would reach that desirable consummation—the purification of coal gas in closed vessels.

Mr. T. Stenhouse (Rochdale) thought it was clear to those who attended the meeting in August that Mr. Veevers did not intend giving a paper on the subject of oxygen purification at this (the November) meeting. In the discussion, he said something about his experience at Dukinfield, and promised to give the results of his working. Oxygen had not been long in use at Dukinfield; and Mr. Veevers could, of course, only give them the experience he had had. Undoubtedly the weak part of the paper was that referring to the different boxes—the sizes of the boxes on the old plan and the new. Mr. Veevers intended to erect six 18 feet square purifiers at a cost of £6000; but, adopting the oxygen process, he had erected only four, at a cost, with the oxygen plant, of £4500. Why did he reduce the number of boxes? If six were required without oxygen, six were he thought needed with it. If with the oxygen no carbonic acid was going to be eliminated from the gas, the four would be sufficient; but, if he intended to remove the carbonic acid, he would still require two more boxes whether he employed oxygen or not. The changing of ten boxes a week was very strange; and must certainly have been due to bad oxide. There was no very great difference between 16-feet and 18-feet boxes—a difference of one-third. But he believed it would be found that, with 16-feet purifying-boxes charged with oxide of iron, there was plenty of space for purifying the gas; and he could not understand why ten boxes should be changed a week, unless the oxide was spent. Another point to be noticed was that Mr. Veevers had no experience of the new purifiers before adopting the oxygen process. Therefore the only comparison was between the new purifiers, *plus* the oxygen process, and the old purifiers (which required changing ten times a week), *minus* the oxygen process. Nothing was said moreover about any change in the oxide after the oxygen process was adopted.

The President: Yes; it is stated that the new boxes were charged with oxide somewhat spent.

Mr. Stenhouse said he had overlooked that. There was no reference to the pressure; and should like to know whether Mr. Veevers found sudden pressure come on after he began to use oxygen. Personally, he should expect that this would be the case, unless it was avoided because of the small quantity of gas purified. They had again no distinct statement as to the illuminating power. There was no bar photometer, as they had heard, at Dukinfield; and by merely gazing at a flame, it was very difficult to tell whether or not it was "a little whiter." No doubt the conclusions at the end of the paper might be fairly taken as facts; but what the advantages there set forth represented in money value was a question which had not been answered.

Mr. C. E. Jones (Chesterfield) thought the discussion should be kept within the four corners of the paper, though he should be sorry to limit the free expression of opinion, particularly if guided by experience. They could hardly call this contribution of Mr. Veevers a paper. If he might coin a word, he should style it a "paperette;" for it did not profess to be a complete epitome of the oxygen process. With regard to the trouble Mr. Veevers had experienced, arising from the subsidence of his machinery, he might say that the Chesterfield district had recently been resewered; they had had an advent of various railways; and underneath all they had their everlasting mining operations. Therefore he knew something of the subsidence of soil, and the letting down of machinery and buildings; and so he could heartily sympathize with Mr. Veevers in this matter, and wish him through his trouble. That he was in difficulties, and that these difficulties were overwhelming was clear; and, having no time to make any elaborate preparations, Mr. Veevers had adopted a system which was chemically and scientifically correct. The only question was that of cost; and, after all, the commercial aspect was very important. They could not make gas with sentiment. They must show a profit, or give it up. Still, if Mr. Veevers went to the oxygen process under the pressure of extreme difficulty, he had done a service by showing what could be accomplished at short notice. The exclusion of nitrogen from the purifiers was fraught with considerable good from a chemical, as well as from a gas manager's, point of view. In considering the question of purification, they must take it as a whole, and know the kind of coal used, and what were the elements to be eliminated. Then they could calculate what the apparatus should be doing. Mr. Veevers did not give these details; and it had been assumed that he had ample purifying power, but that question could not be settled offhand. A point which had not been alluded to, but which was very important, was the immense space which was lost in the present form of purifiers. In many cases in his experience, he had found that 12 or 18 inches of space was lost, because the inlet was circular, instead of taking the shape of a parallelogram or a rectangular form, and so occupying less room. In the covers there was also frequently considerable waste space, in which the gas accumulated, and was given off into the atmosphere when the lid was

removed. In many instances, there must be considerable space above the luting; and, not content with this, many engineers had circular tops to the purifiers to offer storeage for gas, which was simply wasted. He had no doubt that the changing of vessels entailed the loss of millions of feet of gas throughout the country every year; and anything which would assist them to curtail this waste, and bring about a consummation so desirable as the purification of gas in closed vessels, was to be heartily welcomed. Until they obtained this, there must always be a loss of gas in changing vessels. This oxygen process being scientifically correct would assist them in arriving at a true conclusion; and Mr. Veevers had conferred a great favour on the Institution by giving them unreservedly the benefit of his personal experience, than which nothing was more valuable. He should like to know if Mr. Veevers had made tests to decide whether any of the oxygen had gone forward, or whether it was all employed in doing its work in the purifiers. If any portion of it had gone forward, they might in this way account for the whiter light which Mr. Veevers thought he had perceived. It was certainly unfortunate that Dukinfield could not afford a scientific photometer for its scientific gas manager.

Dr. L. T. Thorne (London) said that he was at a little disadvantage in discussing the paper, because he had only seen it as he came into the room. He thought, however, that, when Mr. Veevers promised at the last meeting to give a paper at this meeting, he hardly realized the rapidity with which three months would pass in such a case. If, instead of reading it now, he had postponed it for a further three months, he would have been in a better position to give such results as were asked for by some of the speakers. No doubt the success of any process for gas purification would eventually depend on the question of cost; and therefore it was only just that this point should be very prominently considered. But he believed that, in the assumptions of cost which had been put forward in the adverse criticism of the paper, there had been some important items omitted; and that the advantages to be obtained, according to Mr. Veevers's opinion, and perhaps still more according to the opinion of some others, had been decidedly minimized. On the question of space, for instance, he thought the opinion of Mr. Veevers, that a more limited space might be made available in the oxygen process of purification, than would be required in the ordinary process, was quite borne out by the experience of others, especially that of Mr. Belton, who not only did not put up larger purifiers, but actually knocked off one-third of the old purifiers. This question of saving in purifying space could hardly be put as representing the 5 per cent. interest on the cost of the extra purifiers, because a great number of gas managers were not in the happy position of being able to disregard altogether the question of space as far as the extent of their land was concerned. Very many gas managers had to carefully consider the question of area; and any saving in this direction would be a saving not only in the cost of purifiers, but in land also. Then the saving of labour was an important item; and though Mr. Veevers's experience of the great number of times a purifier had to be changed was perhaps unusual, his present figures compared advantageously with the experience of speakers who had criticized his paper. One member put the change of purifiers at twice a week; while Mr. Veevers, using the oxygen process, and working with oxide which was very far spent, and showed something like 50 per cent. of sulphur, was able to go on without a change of purifiers for four months. This was a decided gain by the oxygen process. Unfortunately, Mr. Veevers had not been able to give any data as to the effect on the illuminating power. He was himself convinced that there was an increase; and he had been able to reduce his use of cannel. They knew that Mr. Ball and Mr. Stenhouse did not admit that there was a rise in the illuminating power at Rochdale. But he (Dr. Thorne) must say still that his view was that, in many cases at all events, they would have, and did have, an increase by this method of purification; and they could not put aside this question in considering the cost. In his own mind, he was still convinced, as the oxygen process was more fully tested in various works and under varying conditions, they would find that, in regard to cost, it would be able to hold its own in the great majority of cases. He was not going to say that in every instance, and in every condition of works, it would be better than other processes—far from it. He thought that, in all systems of a complicated character like that of the manufacture of gas, they must always be dependent on the surrounding circumstances of each case; but he believed the strong and decided way in which criticism had been made by some gentlemen would not be justified by results, and that in the criticism they had overlooked important data which must be taken into account. Certainly, if there was any increase of illuminating power, whether arising directly or indirectly, it must be considered.

Mr. Chester asked how Dr. Thorne accounted for the increase in the illuminating power of the gas. Was the 1 per cent. of oxygen put into the purifier not absorbed in the revivification of the oxide, and did a portion of it go forward with the gas to give this increased illuminating power? Was it because a certain portion of the oxygen was of no use in the purifier that the gas was enriched by its presence?

Dr. Thorne said he believed that, in Mr. Veevers's works, the whole of the oxygen was not used in the purifiers. He did not know whether Mr. Veevers had yet had time to carefully test the exact proportion of oxygen with which the best results were obtained. It was difficult in his case to test the illuminating power. He (Dr. Thorne) believed, however, at Dukinfield not more than 0·6 or 0·7 per cent. of the oxygen was used in the purifiers, and a certain percentage was carried on; and in most cases it was a great advantage to have a small percentage of the oxygen pass on with the purified gas. The increase of illuminating power was, he considered, in many instances, due to the actual presence of oxygen; but in others, part of the effect was owing to action probably going on in the purifiers—either direct chemical action, by which minute quantities of hydrocarbon were generated, or the oxidization of the sulphur compounds in the purifiers might prevent the absorption of the illuminating qualities of the gas on the sides of the purifiers.

Mr. Jones said he had made a note on his memoranda with reference to the illuminating power; but, when speaking before, he was unable to read it because of the attenuated light (the electric light) by which the room was lit up. His note was that the oxygen, being an active agent, would produce a higher temperature in the purifiers; and the result would be that the compounds of the benzol series would be thrown off, and tend to increase the illuminating power.

Mr. W. Carr (Stalybridge) said he would not, like some previous speakers, begin his remarks by apologizing to Mr. Veevers and end by "slating" him. The fact that he had brought before them this paper, which was so open to serious criticism, was proof that he was not a timid individual. He (Mr. Carr) felt very much more concerned about Mr. Veevers's paper after hearing it than he did now, because he presumed that Dr. Thorne did know something about the Brin oxygen process; and after that gentleman's remarks, he had come to the conclusion that there was very little to be said in favour of it. Mr. Veevers said: "Desirous of adopting the most recent and most successful of improvements in this department of the manufacture of gas, I considered some of the plans for the admixture of air." Well, the sentence began very well; but one would have thought that, before adopting this particular system, Mr. Veevers would have thoroughly satisfied himself that this was one of the "most recent and most successful of improvements." He had no doubt that he did this; but, unfortunately, he did not give them the grounds which led him to the adoption of the process. The way in which he fought shy of statistics, indicated that he was not very sure of its merits. After the numerous applications which had been made for the cost of the oxygen, some gentleman interested in it might surely have said it did or did not cost 5s. per 1000 feet. This should be an easy matter to determine; for all that was required was the cost of the labour to put the material in the apparatus, and the cost of the plant and material. After all, it did not matter how scientific a principle might be, they must come down to the question of cost. Every gas manager knew that it was no use talking of reducing space, unless space was not obtainable at all. In that event, he could understand this process being adopted; but unless they could show a distinct monetary gain, the old process would have to go on, however clumsy it might be. Having been away from England for a considerable length of time, he had taken only a distant interest in this question of oxygen purification; but he had expected to find it much more advanced than he did on his return home. He certainly did expect that somebody would know something about it; but so far as he could see, no one knew anything, or if he did know, he did not impart the information. With regard to the emptying of the ten vessels, and losing 20,000 cubic feet of gas, Mr. Braddock was right in saying that the loss was 10,000 feet; and Mr. Veevers had made a mistake. In blowing out the purifier, they only put it in the same position as it was before; so that only one quantity of gas was lost and not two. He hoped Mr. Veevers would survive the criticism. The meeting was indebted to him for the paper, and any remarks which were made upon it, were made with the best feeling for him personally. A man who spoke freely on a paper of this kind did more towards the discussion than one who finessed and tried to say disagreeable things pleasantly.

Mr. T. Duxbury (Darwen) said he understood that this discussion was to be taken as the sequel and supplement to the discussion at Rochdale; and if Mr. Ball or Mr. Stenhouse had anything to add as to their experience with the process since that meeting, it would be as well if it was stated. As to the adoption of this process, he had been in much the same unfortunate position as Mr. Veevers. There was a time when the purifiers at Darwen were most inadequate. He tried different sorts of oxide and lime, and searched for some method of getting out of his difficulty. At one time he took up Cooper's coal-liming process, and thought he had hit upon a method which would get him out of his difficulty; but he had to give it up at the finish. Mr. Jones had made an observation about the amount of impurities which had to be dealt with under varying circumstances and in different works. He (Mr. Duxbury) found that at Tunbridge Wells they had to eliminate 600 grains of sulphuretted hydrogen per 100 feet of gas; while at Darwen the previous week, he had in the crude gas 1630 grains per 100 feet of gas. This was in gas made from Yorkshire coal, which he was now using. They had coal from the neighbourhood of Wigan which he had found containing 2100 grains of sulphuretted hydrogen per 100 feet of gas. It was certainly more difficult to purify gas like this than gas with only 600 grains of sulphuretted hydrogen per 100 feet. When he had

the Cooper coal-liming process in use, he adopted the air process of revivifying the oxide in the boxes. Sometimes he found that the oxide would get hard set; and they had to use a pick-axe to get it out, though it had no more than 25 per cent. of sulphur in it. He should like to know why, with the use of oxygen or air, the oxide or lime did get hard set like this, and they had such heavy back pressure. In his case, the back pressure had gone up to 20 or 22 inches. At Darwen he had 1630 grains of sulphuretted hydrogen in the crude gas; 1410 grains after the scrubber; and 1170 grains after the washer, and at the inlet to the purifiers.

The PRESIDENT: That is 2½ per cent. on the inlet to the purifiers.

Mr. DUXBURY: On the crude gas, it would be about 3½ per cent.; and it seems to me it would be rather expensive to produce oxygen to purify that gas. Mr. Chester said he could purify his gas for 0·4d.

Mr. CHESTER: For labour and material. Practically 0·45d. would do the rest.

Mr. DUXBURY: It costs me nearly double. I do not get it at less than 0·8d.

The PRESIDENT: That is evidently in consequence of the large amount of sulphur compounds the gas contains.

Mr. DUXBURY, alluding to Mr. Braddock's warning respecting the firing of the oxide, said he should like to know from Dr. Thorne, Mr. Stenhouse, or Mr. Ball whether there was any tendency to this with the use of oxygen. In the paper read by Mr. Stenhouse at the last meeting, there was a statement that, "where sufficient oxygen was continuously used, carbonic acid gas would decompose the lime in the used-up boxes, and liberate sulphuretted hydrogen." Dr. Thorne said he had made experiments, and found exactly the reverse to be the case. Could either of these gentlemen now clear up this point?

Mr. STENHOUSE said what he meant was that occasionally they had more sulphuretted hydrogen leaving the boxes than entered them; but it must be noticed that generally they had not sufficient oxygen to treat the gas as Dr. Thorne recommended. They ordinarily used 0·7 or 0·8 per cent. of oxygen, when they should have used 1 per cent.

Mr. T. B. BALL (Rochdale) said it might appear somewhat strange that, after a considerable experience of the use of oxygen, one was not able to say at once what the cost of producing it was. But there were a good many factors going to make up the actual cost of the oxygen as it was delivered into the gas, some of which could be readily determined, while others could not. The interest on the outlay and the cost of labour could be readily ascertained. But the cost of the baryta was not so easily determined; for it depended in great measure on the length of time it would work. Mr. Belton, he believed, had been very successful in keeping it in use for a long time. They had not been so successful at Rochdale; and consequently the outlay had been much greater in their case. The cost of attendance depended upon whether they charged the whole of a man's time or part of it. They could get pretty near the total cost.

Mr. CHESTER: Is it 5s.?

Mr. BALL replied that he did not think it would amount to that in their case. The reason he had given was the only one which prevented him replying to Mr. Carr's question at the last meeting. They could not say in so many words that the cost was 4s. 6d. or 4s. 9d. or 5s. The point which Mr. Duxbury raised was also a very material one. In the paper read by Mr. Carpenter before the Southern District Association of Gas Engineers, he dealt with only 340 grains of sulphuretted hydrogen at the inlet to his purifier, and admitted 1 per cent. of oxygen. At Rochdale, the average quantity of sulphuretted hydrogen might be put at 1000 or 1100 grains per 100 cubic feet. He had used lime and oxide; and with both they had experienced this difficulty of the caking of the material. In the past week they had to change two boxes, because the lime had set so hard that the gas could not pass through it. There were 10 inches of pressure on one of the boxes.

Mr. DUXBURY: Was it hard and dry, or hard and wet?

Mr. BALL: Very dry indeed; and although you may break up the lime and use it again for some time, this is rather expensive; and it is very doubtful whether the labour on it is paid for by the length of time it will work. He was sorry they had not any additional data to give as the result of their use of the process at Rochdale; but at this time of the year, they had no spare time for experiments.

Dr. THORNE remarked that, with regard to the cost, he quite agreed with Mr. Ball as to the difficulty of giving exact figures, because it must depend to a large extent on the circumstances. But he thought they would be safe in saying that the cost of making oxygen in gas-works, including interest on plant and an equitable proportion for labour, should not exceed from 4s. to 4s. 6d. per 1000 cubic feet.

Mr. CHESTER: Are you including royalty now?

Dr. THORNE: No. Mr. Belton, after working it for some time, gave as careful an estimate as he could, and put down the cost at 3s. 6d. in his works. He (Dr. Thorne), however, was inclined to put it at 4s. as a safer figure.

Mr. W. W. HUTCHINSON (Barnsley) asked for the cost of the installation of the oxygen plant apart from the purifying plant, and said he did not gather from the paper what proportion of the £4000 there referred to was for the oxygen plant. He also wished to know if Mr. Veevers had used the process in connection with lime purification. He thought credit was due to Mr. Veevers for giving them the paper, because his recollection was that, at the last meeting, there was a generally expressed wish that the discussion should be continued; and Mr. Veevers had prepared this paper in order that this might be done.

Mr. S. GLOVER (St. Helens) asked if the oxygen assisted in the elimination of the bisulphide of carbon—in other words, if they had to work under the Metropolitan Gas Referees, and had to reduce the sulphur compounds to 12 or 14 grains, would this process assist them to do that?

The PRESIDENT: Mr. Carpenter said he admitted oxygen or air at the third purifier containing lime; and the sulphur compounds were reduced in consequence.

Mr. G. E. STEVENSON (Manchester) thought one element was wanting in the discussion of this subject—viz., a reference to the use of lime in the process. It seemed to him that, if there was any great advantage in the process, it must be obtained in connection with the use of lime, because the principal saving must be in that material. For removing the sulphur compounds, lime was necessary; and managers of gas-works were familiar with the use of lime for this purpose. The ease with which Mr. Carpenter was able to reduce the sulphur compounds while having only a limited purifying area, seemed to show that he brought the oxygen in the form of air into the purifiers which had been fouled by sulphur, so as to make them lively, and efficient for taking out the sulphur compounds. He also stated that the difficulty had been to keep the sulphide of calcium active. Many years ago, Mr. H. E. Jones, of the Commercial Gas Company, read a paper before the Institution of Civil Engineers, in which he described the same difficulty. It seemed to him (Mr. Stevenson) that the whole question was one of the use of lime. If they could maintain the sulphide of calcium in such a condition as to take out the sulphur compounds, it was a great advantage. But after all, it was a question of cost; and it appeared to him that it could not possibly be made to pay with the use of oxide, and oxygen costing 4s. or 5s. At Shrewsbury, when he was there in the spring, Mr. Belton gave him a statement of results which he had obtained with the use of oxygen; and there was a considerable saving in the amount of lime required for purification. He (Mr. Stevenson) did not compare this saving with the cost of the oxygen, and was not able to form any opinion upon it. But that seemed to him to be the point which they wanted to know something about. As to the area for purification, some gentlemen seemed to be of opinion that a million cubic feet of gas should go through purifiers 16 feet square. It was not so. Purifiers 16 feet square would be necessary for half a million feet; and for a million, they would want them 24 feet square. Certain things were laid down for their guidance by Mr. Newbigging and others; and this was one of them.

Mr. A. GRAHAM (Hebden Bridge) said he often used oxygen for purification while he was at Lymm; one of the gentlemen connected with the works there having some connection with the Manchester Oxygen Company. The use of the oxygen resulted in a great saving of lime. He had changed four or five purifiers a week; but, after introducing oxygen, five changes a fortnight were sufficient. The purification was by lime; and when it was taken from the boxes, it was as green as grass, and had no odour. The quantity of oxygen he employed was 0·6 per cent. He could not perceive any difference in the illuminating power; but, like Mr. Veevers, he had no bar photometer, and so could not test it. As to Mr. Veevers's statement that he changed ten boxes in a week, all he could say was that if the same oxide was being used now, and he could get as he said 13 million cubic feet of gas through it, he should only have to change four or five boxes a year. At Hebden Bridge, with a make of 50 millions, he had four 12 feet boxes; and he only changed three a week. He thought there must be some mistake as to Mr. Veevers having changed ten in that period.

Mr. VEEVERS, replying to the various speakers, said he must acknowledge that he had made one mistake—the mistake of printing and circulating the paper before he read it. The gentlemen who had discussed it had prepared figures, and thrown them at his head in such profusion that he could not possibly remember them. He noticed, however, that Mr. Chester omitted the saving in the cannel; and the realizing of the same, if not better, illuminating power by the process. His paper did not profess to be what Mr. Carr said it ought to be—a highly scientific paper. It was more a bit of autobiography. He promised to give something in order to keep the matter before the members; and his paper was not much, but sufficient for discussion. He did not mean to say he changed ten boxes every week; but occasionally, when the oxide was far spent, he had to change boxes in their turn to the number of ten.

Mr. JONES: I once changed four a day, with lime; but they were very small, and totally inadequate.

Mr. VEEVERS, continuing, said he did not even advise the members to adopt the process; he simply told them what led him up to it. Theoretically, the thing was right; and time no doubt would prove it practically correct. Mr. W. Carr referred to the omission of statistics; but really he had no statistics to give. The process was only in its infancy with him. If Mr. Ball could not give them figures with his longer experience of the process, how could he after his shorter one? He had four boxes instead of six, because of advice he had at Shrewsbury.

Mr. Belton told him he could do with fewer boxes than he had before, and strongly advised him to have only four. He certainly did not take out the carbonic acid gas. It would be interesting to know whether one should use lime or oxide with this process. He believed his were the only works where oxide was used; and it might be useful to have a comparison between his works and those of Mr. Belton, where lime only was employed. The cost of the apparatus was about £800. They might go past the heap of spent lime from the purifiers in works where oxygen was used, and not perceive the least odour. This was a point of some importance in works which were situated in the midst of towns. At the end of twelve months he might give the sequel to this paper, and brave any storm that might threaten him again.

Mr. CHESTER moved that the thanks of the meeting be given to Mr. Veevers for his paper. He said that, however severe the criticism might have been, he thought it was apparent that Mr. Veevers had taken it in good part. Their gratitude was due to him for having promised another paper, which would enable them to continue this discussion at some future time.

Mr. JONES seconded the motion.

The motion was carried by acclamation, and Mr. VEEVERS briefly acknowledged it.

An Explosion in a Tar-Well.

Mr. CHESTER then read his paper entitled "An Account of a Recent Explosion in a Tar-Well," which appeared in last week's JOURNAL.

Mr. C. E. JONES opened the discussion by saying that he endorsed the conclusion arrived at by Mr. Chester, with this addition—that he maintained that all closed tar-wells should be ventialted. They were so at the works under his charge. A considerable quantity of gas was given off from tar-wells; and he had wondered whether it would not be possible to exhaust this gas by means of a weighted gasholder or other means, and then enrich it by some form of carburetter, and so sell it with the general stock of gas. His opinion was that the Nottingham explosion was caused by ignition from the revivifying shed. They had it that gas was carried over by the liquids which entered the well. Anybody who took the trouble to experiment would find that a considerable quantity of gas was carried over by mechanical means; and this being so, the gas would accumulate over the liquor in the well, and form an explosive mixture. As no fire followed the explosion, he took it that the force was exhausted in lifting the roof, and so on.

Mr. W. CARR said there was one point which Mr. Chester made that would afford a good opportunity for some one to present a very interesting paper at some future time. This explosion, as Mr. Chester said, pointed to the necessity of having the scrubber plant of the highest efficiency, so that ammonia purification might be effected with the smallest possible quantity of liquor. Now what was the best scrubbing apparatus? He quite agreed with Mr. Chester's conclusion as to the way in which the explosion took place; and as Mr. Jones said, all tar-wells ought to be ventilated, particularly if in any position where ignition could take place.

Mr. G. E. STEVENSON fully endorsed what Mr. Jones said about the desirableness of having tar-wells ventilated; and moreover liquor-sealed pipes should be conducted into separate vessels, and not into the well. He had always adopted the plan of having two sealed pipes in his works coming into one receptacle, a cast-iron vessel with cast-iron flanges. With plenty of seal, they thus prevented the gas being carried forward into the tar-well. Another question was, of what material should the well be constructed? They always found very great differences in the amount of liquor recovered from different wells. In some they would get 26 gallons of 10-oz. liquor, and in others it would get up to 32 gallons. What was the cause of this difference? Brick tanks were very doubtful as to being absolutely tight; and if he were constructing another works, he should put down cast-iron tanks, which were very much better.

Mr. STENHOUSE said that many years ago, when there was an explosion in the tar-well at Bury, he tested the gas above the liquor; and since the explosion occurred at Nottingham, he had tested it again at Rochdale. He found that, when there was plenty of liquor, there was no gas. He collected many different samples in big bottles, and found that it neither exploded nor fired, but allowed a taper to burn in the mixture. He believed that, if there was any quantity of liquor in the tar-well, there would be no explosive gas there. Mr. Chester said that no explosive vapours were given off from the tar where the temperature was low. There must, of course, be a temperature of 80° C. for them to be given off. The fact was, however, that these compounds would give off explosive vapours at a very low temperature. Naphtha was given off at a low temperature; and if the tar was near the top, the upper part (containing the naphtha and benzol) would quickly give off, and there would be an explosive compound in the well. He thought the circumstance about the man having gone through the place some five minutes before the explosion at Nottingham was very suspicious. It was Sunday morning, too; and though no smoking was ever allowed in the works, men were not always to be relied on in the absence of the manager and foreman.

Mr. W. W. WOODWARD (Bromley) said he went to Bury shortly after the explosion which had been referred to by Mr. Stenhouse. He believed that the explosion in this case was due to the tar and liquor in the hydraulic-main. They had filled the hydraulic main, and it led to results which caused the explosion.

Mr. T. B. BALL referred to the large quantity of liquor used in the scrubbers at Mr. Chester's works. They were told in the paper that liquor passed the scrubbers at the rate of one volume for every 137 volumes of gas. This excessive quantity was, he thought, much more likely than anything else to have carried the gas forward.

Mr. W. W. HUTCHINSON said the paper had recalled to his mind the fact that, on three separate occasions, they had had at Barnsley a separation of the light oil or naphtha from the other liquor in the liquor-well. It almost smelt like naphtha, and floated on the surface of the liquor. He asked if Mr. Chester had noticed anything like that. If he had, it might readily account for the explosion, for it was very volatile.

Mr. CHESTER said he had noticed the light oil floating on the surface of the liquor at different times; but he was of opinion that this was not the cause of the explosion he had referred to. If there had been any quantity of light oil on the top of the liquor, they would in all probability have had fire after the explosion, and the result would have been a general conflagration of the oils. As there was no fire, he had come to the conclusion that there could not have been any large quantity of light oils on the surface. He attributed the explosion absolutely and entirely to the large quantity of liquor that was being sent through the scrubber unnecessarily. He looked upon it as at least twenty times too much; and if there was only a limited quantity there would be less liability to carry the gas forward. He did not think, with Mr. Stenhouse, that the explosion was caused by the volatile hydrocarbons from the tar; for there was water over the whole surface, which kept off the air.

The PRESIDENT: Some of these oils are lighter than water.

Mr. CHESTER: But if they were, we should have had fire.

Mr. STENHOUSE: If the oxygen were used up in the explosion, there would be no oxygen for combustion.

Mr. CHESTER: That would be so, if there were no openings to the tar-well. He thought the correct conclusion to come to was that a gaseous mixture was carried forward in a mechanical way; and this was then ignited in some way which could not be explained. Fortunately, the explosion did not cost them more than £200 or £250.

The PRESIDENT moved a vote of thanks to Mr. Chester for his paper.

Mr. CHESTER briefly acknowledged the vote; and the business portion of the meeting ended.

Proposed Municipal Gas-Works for Vienna.—By an advertisement which appears in another part of the JOURNAL, it will be seen that the Municipal Council of Vienna are inviting plans for the erection of works for the supply of gas for public and private lighting in the portion of the city for which contracts are not in force with the Austrian Gas Lighting Association. It is proposed to award three prizes—of 8000, 5000, and 3000 florins—for the best projects submitted.

The Appointment at the Rochester Gas-Works.—After very careful investigation, the Directors of the Rochester Gas Company, who recently advertised in the JOURNAL for an Assistant-Manager, Engineer, and Secretary, have selected Mr. James M. Veevers, out of some 85 applications received in response to the advertisement. Mr. Veevers has been Manager of the Denton Gas-Works since the year 1884, when the district formerly supplied with gas by the combined Dukinfield, Denton, and Haughton Local Boards was divided, and Mr. Harrison Veevers retained the control of the Dukinfield district, while his son, Mr. J. M. Veevers, took charge of the works supplying Denton.

Some New Applications of Coal Gas.—We learn that during the past fortnight Messrs. Fletcher, Russell, and Co., Limited, have completed some new arrangements for the use of coal gas as a fuel. A machine for moulding ornamental glasswork, such as dishes and similar articles, has been successfully started; the only difficulty being what is known as the "glory hole" for flashing a polished surface on the work by exposure to an intense heat for a few seconds. This has been accomplished in a very simple manner; the interesting part of the arrangement to gas manufacturers being that a gas consumption of about 400 cubic feet per hour is required. As glass-houses generally run night and day, even a single machine of this kind will be a desirable neighbour to the local gas engineer. Another application of gas is in the heating of a cast-iron plate 17 ft. by 2 ft. 6 in., for casting plates for the manufacture of organ-pipes. This is, of course, not a large or universal business; but as the gas consumption is 200 cubic feet per hour (all day gas), it is a desirable help. The last appliance completed is a series of burners for heating pitch-troughs for making reeds for power-looms for calico-weaving. These burners each consume about 40 cubic feet of gas per hour; and as the industry is a pretty large one, the application is worth consideration. At least one of the above-mentioned arrangements is entirely new; and the fact that all three were ordered and made within a week, shows that the tendency towards the use of day gas for trade purposes keeps well to the front.

THE IMPROVED WELSBACH INCANDESCENT GAS-LIGHT.

It will be in the recollection of our readers that considerable interest was aroused a few years ago by the introduction of the new system of incandescent gas lighting devised by Dr. Auer von Welsbach. The merits of the new light were duly appreciated, and it was employed in a great number of establishments; but practical experience of its use revealed certain defects which militated against its very general adoption. The chief objection to the system was one which struck at its vital principle. The mantle of refractory material by which the light was produced was found to be too fragile, and its life too short, to enable consumers to realize the full economy claimed for it. These drawbacks were fully recognized by the inventor of the light and by those who were endeavouring to make it a commercial success; and they very prudently turned their attention to the removal of them. The result has been the production of a mantle which, as far as we have been able to learn, is much more satisfactory than any of its predecessors.

The improvements that have been effected in the system will be manifest from the following figures: When the Welsbach burner was first brought out, the light obtained from it with a consumption of 2·75 cubic feet of gas per hour was from 20 to 25 candles, or an average of 8 candles per cubic foot. Now, with the same quantity of gas, a light of from 50 to 60 candles is produced, or an average of 19 candles per cubic foot. This improved lighting power is due to the changes introduced into the method of manufacturing the mantles; one of the principal ingredients with which they are impregnated being subjected to a delicate chemical process which heightens their luminosity. With regard to their durability—a very important point—great advance has been made in this respect. The mantles produced under the old process would not last more than 800 hours—that is to say, for doing really good work. After having been in use for this period, their efficiency decreased considerably. Those which are now being made have, we are informed, burnt for upwards of 3000 hours with a loss of not more than 25 per cent. This long life is not, however, claimed by the exploiters of the light (the Incandescent Gas-Light Company, Limited) as general; 1000 hours being estimated by them as the duration of the mantle for practical purposes. We learn that the improvements which have been effected in the Welsbach system have resulted in a marked extension of incandescent gas lighting in Austria, where it has received the serious attention of all interested in the supply of coal gas; and the result has been to counteract to a very large extent the adoption of electric lighting. In fact, several large installations of the latter system in Vienna have, we understand, been discarded in favour of incandescent gas lighting, with which nearly every establishment of any importance is now illuminated. It is only during the present year that the above-named Company have been able to develop the improved Welsbach system in a practical form in England; but the success which has already attended their efforts in this direction shows unmistakeably that the changes made have produced a light which is giving great satisfaction.

Of course, it is not for a moment proposed on behalf of the Company—it would be useless to do so—to put forward the Welsbach incandescent burners in competition with the large gas-lamps of the regenerative type which are now so largely and so effectively employed for shop as well as private lighting; but, apart from these, it would, we think, be difficult to find in the market any system of gas lighting possessing the special qualities of economical and efficient illumination, combined with hygienic advantages, which are claimed for the Welsbach light as now manufactured.

Water Gas on the Continent.—Mr. F. D. Marshall, Engineer-in-Chief of the Danish Gas Company, has written to us in reference to the paragraph on the subject of the water-gas plant at the Copenhagen Gas-Works, which appeared in the JOURNAL for the 22nd ult. He points out that Copenhagen, in conjunction with Frederiksberg, is a large city, and is lighted by the eastern and western gas-works of the Municipality. It was the Manager of the latter station (Mr. N. O. Petersen) who, as we stated last week, was sent to America to report on water-gas processes; and it is in his works that water-gas plant is being erected under Mr. Glasgow's supervision. The Frederiksberg portion of the city, and the suburbs, are served by the Danish Gas Company, who also light Odense, Elsinore, Aalborg, Viborg, Randers, Veile, Assens, and Flensburg (Germany). The Company are just completing a tenth works, to supply the coast district of Copenhagen. They are to supply almost entirely gas to be used for cooking or domestic purposes—the lighting service being regarded as supplementary; and it is in contemplation to erect at the works water-gas plant in conjunction with the coal-gas plant. The curious part of the new business is that the works will be in full operation in the summer, and in the winter almost closed. The demand for gas for culinary purposes is enormous in Denmark; and the Company's energies and resources are taxed to the utmost to keep pace with the requirements.

REGISTER OF PATENTS.

Automatic Arrangement for Putting Gas-Stoves in and out of Use.—Rowbottom, S., of Derby. No. 22,077; Dec. 17, 1891.

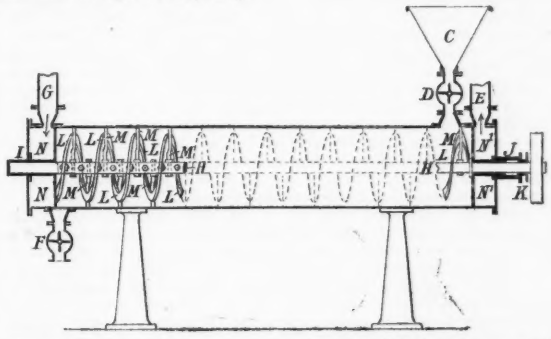
This invention relates to apparatus for automatically boiling water or the like, cooking various articles, or lighting gas stoves, ovens, furnaces, &c.; it being capable of being set in action at a given time, by means of an alarum clock, and, if necessary, stopped when the water is boiled and fed to the tea-pot or other vessel. Such an arrangement may be applied to a variety of uses—for instance, to the lighting of any ordinary gas fire, stove, oven, or cooker, or to a stove which will boil and cook at the same time, and is so arranged as to keep back the boiling of the water (by placing iron plates under the kettle, or by other suitable means) until the articles in the stove are cooked, and thus the whole will be ready at one time.

Meter for Liquids or Gases under Pressure.—Mills, B. J. B.; communicated by T. Blein and E. Béraud, of Lyons, France. No. 22,325; Dec. 21, 1891.

The measuring of liquids or gases, according to this invention, is effected by the alternating movement of a piston pushed by the pressure of the fluid itself, which latter is admitted alternately to one or the other side of the piston. The improvement consists in the means for obtaining the distribution of the fluid on the two sides of the piston, and of transmitting to an exterior counter the movements of the piston. This slides upon a central rod giving motion to the distribution slide-valve, by a combination of springs compressed alternately by the piston upon the stops of the rod, with levers latching the stops, and studs or buttons unlatching the levers at the precise moment when the piston has completed its course. A shaft passes through the side of the cylinder, and gives motion at the exterior to a counter registering the to-and-fro motions of the piston; the shaft being operated directly by the piston, by means of an internal ratchet-wheel.

Gas Purifying Apparatus.—Williams, H., of Stockport. No. 24; Jan. 1, 1892.

The object of this invention is to obtain a passing of the lime (or oxide) through the purifier, so as to dispense with the present necessity for withdrawing the spent material at intervals and recharging with fresh. This is effected by employing chambers, through which the gas and the lime pass in opposite directions—the lime in at one end and out at the other during the working of the apparatus. The cylindrical or conical form of apparatus is considered most suitable. The crushed or comminuted lime is passed into the cylinder at or near the gas-exit end; and it passes out at or near the gas-inlet end. The lime travels through the chamber by means of a revolving worm or helix, or of propelling blades carried by a revolving shaft; and it is at the same time stirred up, and kept in motion, so that all the particles of it are exposed to the gas. The chambers may be inclined, so as to facilitate the onward passage of the lime; or if the chamber be of conical formation, the lime may be admitted at the smaller end. As the incoming gas meets the spent lime, and the gas before leaving is always brought into contact with fresh lime, there is, says the patentee, "great economy of material, attended with practical efficiency." He also remarks that an advantage attendant upon the using of the apparatus would be, that "at times of pressure, when the gas production must be increased, the purifying capacity can be increased by passing the gas and lime through more quickly."



The body of the purifier consists of a cylindrical casing, mounted on supports, or carried in any suitable manner. At the right-hand end of the casing is placed the lime-feeding hopper C and valve D; and at the same end is situated the gas-exit pipe E. At the opposite end of the casing, there is the lime-ejecting valve F and the pipe G for admitting the gas to be purified. Through the centre of the cylindrical casing, there runs a shaft H carried in bearings at I and J and driven from K. This shaft carries a spiral blade L, supported by means of supports M bolted to the square shaft. In addition to these supports, the shaft might also carry tines or forks to stir up and throw about the lime while the gas is passing through it. Instead of a helical blade L (as shown), the feeding forward of the lime might be effected by propeller blades or paddles fixed to the shaft and revolving with it. At each end of the spiral blade, there is a perforated plate N and N¹ which cuts off a space at each end of the cylinder. The gas on entering is strained through the perforated plate N before coming in contact with the lime. At the other end, the purified gas passes through the perforated plate N¹, and makes its exit by the pipe E; the perforated plate N¹ preventing lime dust passing out with the purified gas.

When the apparatus is in operation, the lime is thrown into the hopper C, and fed by the revolving valve D into the casing, along which it is carried by the revolving spiral L. At the same time, gas is admitted by the pipe G, and is forced or drawn through the casing, so as to meet and come in contact with the advancing lime—being thereby

purified, and issuing from the casing through the pipe E. The lime becomes spent as it passes along; and it is finally thrown out by the revolving valve F.

APPLICATIONS FOR LETTERS PATENT.

21,266.—ASHBY, A., "Gas-engines." Nov. 22.

21,275.—LEWIS, J. H., "Apparatus for the absorption of chlorine and other gases (applicable also to the washing or scrubbing of gases)." Nov. 22.

21,327.—TAYLOR, C., "Gas-burners." Nov. 23.

21,334.—WHITEHOUSE, H., "Gas-stoves and other heating stoves and apparatus." Nov. 23.

21,395.—WOODWARD, J., "Driving and working stoking machinery for gas-retorts, and machinery used in connection therewith." Nov. 24.

21,444.—ADCOCK, R., "Smoke consumer for destroying the carbon products of gas combustion and increasing the power of the gaslight." Nov. 24.

21,475.—ENGER, L. A., and Co., "Gas engines or motors." Nov. 24.

21,476.—ELLERY, C. S., "Manufacture of ammonium sulphate and other salts." Nov. 24.

21,568.—MATHIEU, E., "Liquid-meters." Nov. 25.

21,647-8.—DVORKOVITZ, P., "Manufacture of gas and of bye-products from liquid hydrocarbons." Nov. 26.

21,649.—PATERSON, R. O., "Manufacture of gas for illuminating or other purposes." Nov. 26.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Purification.

SIR,—I have great pleasure in replying to the questions put by Mr. Stenhouse in the last number of the JOURNAL. First let me put him right as to the total amount of impurities present in the scrubbed gas. I mentioned, *inter alia*, in the course of reading my paper, that the remarks made therein as to the figure for carbon dioxide percentage given in the "Cycle of Purifiers" table, applied also to the sulphuretted hydrogen; and that the actual percentages, found by the Orsat apparatus, were 1·5 and 1·2 respectively—the latter figure representing 750 grains of sulphur. I also stated my reasons for giving the amounts of these impurities as indicated by the Harcourt colour test—namely, that this was chiefly used for the purpose throughout the country, and that engineers would therefore be more readily able to compare them with their own working results.

As regards the duty performed by the purifiers, I need not remind Mr. Stenhouse that in London we are under very severe restrictions as regards sulphur compounds; and therefore it is necessary that any change in the method of working should be very carefully and cautiously made. Since the paper was read, however, though our make has increased until our purifying area is now only 241 superficial feet per million, the duty of the lime used has gone up to 35 tons of coal purified per yard, with the prospect of still further improvement. If Mr. Stenhouse will take this together with the above statement of the impurities in the scrubbed gas, I think he will be bound to admit that the new system is even yet acting very well.

Now as regards the necessary air. Mr. Stenhouse does not quote me quite correctly when he states that I recommended the admission of 1 per cent. of air to the third or fourth purifier in a rotation set. What I do emphatically recommend, however, is the introduction of air in the manner indicated; but, as regards the quantity, I simply stated that 1 per cent. (equal to 0·2 per cent. of oxygen) was sufficient—that is to say, that more was unnecessary. We have since been able, without ill effect, to reduce this quantity considerably, though I am not at present prepared to state the minimum required; for, as already pointed out, it is necessary to be very careful with all experimental changes.

As regards waste of oxygen when air is admitted before the exhauster, all our experiments prove this to be the case; and that if 1 per cent. of air does reach the first lime box, it is nearly always wholly absorbed therein—a little passing when the box is carbonated.

I fear from the fifth paragraph of Mr. Stenhouse's letter that the drift of one point of my paper is not quite clear in its summary. Mr. Stenhouse is no doubt aware that it has been laid down as an axiom that, in using oxygen, it should be proportioned to the amount of sulphuretted hydrogen present. I say that, on the contrary, the sulphuretted hydrogen should be driven forward into the oxide of iron, whence it can be extracted profitably, and that only sufficient oxygen to deal with the carbon bisulphide should be admitted.

This brings me to the consideration of Mr. Stenhouse's objection to my assertion that it is impossible to make an effective sulphide by passing sulphuretted hydrogen into clean lime—air being excluded. I can assure Mr. Stenhouse that this has been tried over and over again, month after month, without success; and that the only way the desired end could be attained was by taking out the sulphided lime, exposing it to air, and replacing it in the purifier; and this is common experience among engineers.

An experiment bearing on this may be of interest. Some scrubbed gas was passed through an experimental purifier, with the above-mentioned result. A small scrubber in which fresh water was freely used was then interposed, and an effective sulphide was at once produced. But on attempting to use the water "over and over," inert material was again the result. It was stated that the cause was the presence in the crude gas of some mysterious difficultly soluble compound, which prevented the formation of an effective sulphide. But I have since found that the dissolved air was the determining factor; for the same result was obtained using fresh boiled water.

Let me remind Mr. Stenhouse that equations have their use and misuse; and that others than the two he gives have by some been put forward as the reaction resulting in the absorption of the carbon bisulphide in lime purification. Veley's laudable endeavour was to ascertain what compound of lime with sulphur was effective for this purpose; yet I do not think he put forward his results dogmatically, or as possessing the infallibility Mr. Stenhouse seems disposed to attach to them.

In conclusion, I may say I was extremely pleased to read, in Mr. Linging's experiences, so thorough a confirmation of my own; his letter, indeed, answering several of Mr. Stenhouse's queries. I believe, however, that the Beckton system, to which the name of the late Mr. Patterson has been attached, included the interposition of oxide of iron between the carbonate and sulphide vessels, and that the initiative in this was antecedent to the investigations of Mr. H. E. Jones.

Vauxhall, Dec. 3, 1892. C. C. CARPENTER.

SIR,—I think that one need not go beyond the fact stated both by Mr. Carpenter and Mr. Linging, that exposure of partially fouled lime increases the temperature, and renders it useful in removing the carbon disulphide, to see the advantage of admitting air into the fourth or third lime box. Though the reactions given by Mr. Stenhouse do not require the admission of air, yet the very fact that the temperature increases, proves active oxidation, with formation of sulphite ($CaSO_3$). Whether heat alone would be sufficient, I do not know; but I shall, at the earliest opportunity, endeavour to prove the truth or otherwise of this. Further, I shall endeavour to fix, within a limit, the temperature best adapted for these reactions to take place. The point I wish to decide is whether air is only useful in the sulphide box in so far as it causes an increase of temperature; whether it is useful for the chemical changes produced; or whether it is partially useful in both ways. Perhaps Mr. Stenhouse would say.

With respect to Weldon mud—which, by the way, I thoroughly believe in as regards efficiency—may I ask Mr. Carpenter what effect the improved working in the manufacture of alkali will have upon the price of this article?

I have no doubt that ere long our methods of purification will be so far improved upon as to pay for themselves at least. Yet, as Mr. Gandon points out, one is afraid to experiment, on account of the fast line drawn as regards sulphur.

Dec. 1, 1892. R. S. MOSS.

Regenerative *v.* Ordinary Settings.

SIR,—"H. L.'s" communication was not overlooked, as your correspondent, "Sancho Panza," supposes. I carefully read it, and duly admired the skilful manner in which he sought to cover his retreat from an untenable position. "H. L." remarks that a difference of 25 per cent. in the yield of coke requires some explanation. Doubtless it does; but I am not the person to explain. Having pointed out the error which led to such impossible conclusions, my duty ends.

"Sancho Panza" admits that he does not possess much practical knowledge of the bushel; and yet, sheltered behind a *nom de plume*, he does not hesitate to air his very "hazy notions," and venture upon erroneous "suppositions."

The subject under discussion is "Regenerators *v.* Ordinary Settings;" and it would be folly to allow the side issue, as to what is the weight of a bushel of coke, to take the place of the metaphorical red herring. One ton of Pelton Main will yield 48 bushels of coke; and, further, it has been shown upon undisputed authority that North Country coal will average a yield of 50 bushels per ton. It has also been publicly stated by the Chairman of the South Metropolitan Gas Company that all the London Gas Companies produced that measure per ton of coal carbonized; and the statement has never been called in question.

No more unsatisfactory method could be adopted, to determine the quantity of fuel used in any works, than the use of the bushel measure. Any method of assuming a certain make of coke per ton, from which the quantity sold is then deducted, and the remainder taken as the quantity of fuel used, is open to objection, and is often most misleading. The only safe and reliable course, in order to ascertain the fuel used, is to weigh it hot.

So far, during this correspondence, the advantages claimed for gaseous firing in my address at Bournemouth, have only been confirmed; and I repeat that "the regenerative system or principle of heating gas-retorts is theoretically perfect; and the theory has been abundantly illustrated and proved in almost every part of the country. Yet with all these admitted advantages, advantages confirmed in my own experience, gaseous furnaces do not receive the consideration their merits claim."

Bristol, Dec. 4, 1892. D. IRVING.

The Use of Sprayed Oil as an Enricher.

SIR,—Replying to Mr. Herring's letter in your issue of Nov. 29, in answer to mine in the JOURNAL for Nov. 22, on the above subject, I beg to say that, having by means of the JOURNAL made known to the gas profession how Mr. Herring has tried to rob me of the credit of my process, I shall take no further notice, but leave gas engineers and managers to judge to whom the credit is due. I am not in a position to go to law with Mr. Herring; as, no doubt, this is his design by remarking that the "remainder must, if necessary, be decided by other means."

The only way that Mr. Herring can get out of this mean business is to prove that he had a similar process to mine in use *before* he first spoke to me upon this subject (which I beg to remind him of) at Westminster Bridge on the 13th of June, 1888, on the occasion of The Gas Institute's visit to the Beckton works. He then asked me about my system of enriching gas with oil, and whether it was a good substitute for cannel, as if so he would like to try it. I had then had it in operation since Nov. 21, 1887—this being the exact date I first used the "squirt" (so called by a member of the Southern Association at one of their meetings, when a paper was read on this subject).

The "squirt," I may mention, was only used by me on the score of economy, and until I was sure my process was a success. After very satisfactory results, I made an apparatus for using either oil, tar, or other liquids; and I have had the same arrangement in use ever since. It is safe, simple, and inexpensive compared with other systems of using oil as an enricher; and I think I hardly need draw gas

managers' attention to the danger of having pipes charged with oil under a heavy pressure in a retort-house, especially when leading to several benches. Under my arrangement, one bench only would be required for a gas-works using say 10,000 to 15,000 tons of coal per annum, which would probably be about the average of all the works in existence.

Carshalton, Nov. 30, 1892. R. GOOD.

The Six-Lift Holder at East Greenwich.

SIR,—Mr. Livesey's letter in your last issue appears to place me in a somewhat incorrect light. It is necessary to reiterate that there are two problems which are apt to get confused—the consequences resulting from allowing one or two lifts out of three to go free of the guide-framing, in a holder supported at the *sides*, as in the case of Mr. Livesey's own original innovation; and the result of guiding a holder entirely from the base, on spiral guides. That which is true of one of these methods, is not necessarily true of the other. Indeed, entirely different conditions are involved.

To prevent any possible misunderstanding, I say at once that I perfectly agree with Mr. Livesey in his conclusion with regard to the first of these two problems—viz., that it is not safe to shorten the framing by more than about one-third of the total height. But I arrive at this conclusion, not because of the racking stresses on the sheeting, because I find far more cogent and earlier reasons than these for stopping the shortening process at the point indicated. These reasons, I have pretty fully dealt with.

I did not, and do not, however, understand Mr. Livesey to challenge me on this problem, which is peculiarly his own. I imagined, and I think others also understood, his question related to the action on the sheeting in my own spiral method. With regard to this latter problem, nothing would give me greater pleasure than to lay before Mr. Livesey, and the gas fraternity generally, my views and proofs of the effects of such action. But life is far too short, and I am too much in earnest to waste valuable time and columns of printed matter merely to correct what appears to me as persistent misrepresentation of my meaning, or to repel personal attacks upon my truthfulness or honour.

Nevertheless an opportunity may occur ere long for a physical and theoretical demonstration. In the meantime, the size of holders being erected, which are guided from the base, is steadily growing; and thus the truth of my position is receiving that practical proof which Mr. Livesey so rightly considers to be superior to mere speculation.

Manchester, Dec. 3, 1892. W. GADD.

Eveson's Compound for Stopped Ascension-Pipes.

SIR,—My attention has been called to the report given, in your issue of Nov. 8, of the discussion on "Stopped Ascension-Pipes," at the meeting of the Midland Association of Gas Managers held in Birmingham on Oct. 27, when Mr. Hack, of Birmingham, stated that "as to Eveson's patent compound, which was to be an 'infallible cure,' it was of no use whatever." Now, Sir, in refutation of such an unwarrantable allegation, I beg to hand you copies of testimonials received from gentlemen of large experience, who have made practical tests of the compound, and found it perfectly satisfactory. I think that Mr. Hack should have fairly tried the compound (which I understand he has not done) before making a public statement likely to prejudice gas managers against it, and one detrimental to the sale of an article which has been found of great benefit in a large number of instances where nothing else has proved of any avail.

I have no doubt that Mr. Hack made the remark unwittingly, and without any intention to injure the manufacturer. At the same time, whatever his intentions may have been, as his criticism is not in accordance with the experience of the practical friends who have an acquaintance with my compound, *and have grasped the simple instructions as to its use*, I think that you will, in all fairness, give the above the same publicity as was accorded to its unjustifiable condemnation.

Birmingham, Nov. 30, 1892. G. J. EVESON.

Gas at a Chinese Festival.

SIR,—Gas has been employed in a variety of ways during the past fifty years; but I venture to say that its use at the Sumbayau Autu, or Feast of Devils, in the Chinese part of the town of Singapore, will take a lot of beating as a novelty. This feast is held yearly, and lasts for a week. The idea is to spread tables loaded with food in the streets, as a feast to propitiate the devils or spirits. The tables are allowed to remain covered with the food from six o'clock in the evening until midnight, by which time the invisible guests are supposed to have taken their fill of the good things prepared; and the food is then eaten by the employees of the firms, or given away to the crowds of Chinese coolies who have been looking on with longing eyes during these hours. The tables are erected in the streets in front of the chief mercantile firms of the Chinese quarter. They are about 100 feet long and 10 feet wide; and along each side of them gas-pipes are run, with jets of gas every few inches. These are called "side lights," and are to show off the dishes. About 200 of them are often burning on one table; while high up above the festive boards are erected scores of devices in gas—"V.I.R.," Prince of Wales's feathers, crowns, &c. These are rather out of keeping with the character of the festival; but, as a rule, the givers of these feasts are not particular as to the kind of device employed, if they only get a good blaze of gas. So Jubilee gas devices come in very well on these occasions. The tables are beautifully decorated with flowers, and are covered with ducks, fowls, fish, roast pigs, cakes, and puddings, prepared in Chinese style; some of the fowls being in the shape of dolls. The fruits are a wonderful show of all the tropical kinds. Small paper flags are stuck all over the dishes; and lighted joss-sticks are also placed at intervals. The most grotesque figures, such as dragons, tigers, monkeys—life size—formed out of tobacco, vermicelli, &c., guard each corner of the tables; and at one end are placed small cups of tea, in the Chinese fashion, without sugar or milk, bottles of brandy, champagne, arrack, &c. Even pipes for smoking, with a plentiful supply of tobacco and opium, are laid out for the use of these jolly spirits.

The scene in these Chinese streets is wonderful. The glare of lights, the crowds of people, the beautiful colours of the dishes on the tables, all go to form a striking picture to English eyes. The crowds were dense; and the noise was almost deafening. Wyangs, or Chinese plays, were being performed on open stages, which were lighted by gas; and there was a great deal of beating of tom-toms, clashing of cymbals, and blowing of Chinese pipes. I was the only woman in all this vast crowd of thousands of Chinese men; but the greatest courtesy and politeness was shown to me as I threaded my way through the crowded streets. I did not see a single person intoxicated; and the greatest good humour prevailed in the motley throng. Chinese women do not walk out in these crowds; but they look on from the windows of the houses along the line of streets.

Singapore, Nov. 8, 1892. AGNES WILLIS-SMITH (*née* Kelman).

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1893) RELATING TO GAS AND WATER SUPPLY AND ELECTRIC LIGHTING.

Aberdeen Gas and Water.—The Corporation of Aberdeen notify their intention of applying for power to purchase, by compulsion or agreement, lands for gas and water supply and other purposes. For the extension of the gas-works, a piece of ground at Scatterburn has been selected; and this, with land already in the possession of the Corporation, is to be utilized. Additional water-works are to be constructed, consisting of a settling reservoir at Invercannie and a service reservoir at Kittybrewster. Authority will be sought to vary existing rates and charges, alter dates for closing gas and other accounts; and raise more money.

Accrington Gas and Water.—The Accrington Gas and Water Company seek to be empowered to obtain additional capital, for the general purposes of their undertaking, by the creation and issue of new ordinary and preference shares and stocks, and by raising money on mortgage and by debentures. So far as may be necessary, the provisions of the Company's Act of 1854, and of the several Acts relating to the undertaking, are to be altered or repealed.

Altrincham Gas.—The Altrincham Gas Company are desirous of obtaining authority to acquire additional land for the purposes of their undertaking, and to erect new works for the manufacture and storeage of gas, and to make and deal in stoves and other appliances. They wish to alter such of the provisions of their Act of 1872 as relate to price and dividends, and to substitute therefor others applying the sliding scale. In the Bill to be promoted to enable the Company to carry out the foregoing objects, provisions will be included relating to the pressure and quality of gas, the formation of insurance, reserve, and pension funds, deposits from consumers, &c.; and more capital will be applied for.

Barnoldswick Local Board.—The Barnoldswick Local Board are about to apply for authority to purchase the undertaking of the Barnoldswick Gas and Light Company, Limited, and to continue the existing works, and others which may be erected. The Company is to be dissolved; and all the rights and privileges belonging thereto are to be transferred to the Local Board. The necessary money powers will be included in the Bill, which will contain provisions in regard to the better government of the district under the Board's control.

Barry and Cadoxton Local Board.—The Barry and Cadoxton Local Board are desirous of acquiring the property of the Barry and Cadoxton Gas and Water Company, and of being empowered to supply gas and water both within and beyond their district. The usual privileges granted to gas companies will be applied for, as well as power to transfer to sanitary and other authorities parts of the acquired undertaking, with all the rights appertaining thereto. The Company is to be wound up, and the assets distributed. Provision will be made for raising the necessary money.

Belfast Water.—The Belfast Water Commissioners intend to apply for authority to construct additional works, comprising a storeage reservoir on the Kilkeel River, a service reservoir in the parish of Drumbo, County Down, and various conduits, &c. The waters of the Kilkeel and Annalong Rivers and their tributaries are to be impounded. Powers will be sought for preventing the pollution of streams and other sources of water, acquiring land, laying down and maintaining pipes for supplying water under pressure, levying rates and charges therefor, and other purposes. Provision will be made for the raising and expenditure of money, the recovery of rates, also for constituting the water-rate books evidence exempting from distress meters let on hire by the Commissioners. Existing Acts relating to the water undertaking of the Corporation are to be amended or repealed.

Bilston Water.—The Bilston Town Commissioners wish to be empowered to carry out certain works for the water supply of their district. They comprise wells and pumping-stations at Wombourne, a covered service reservoir at Penn, and the necessary conduits or pipe-lines to connect these works with the district to be served. Provision is to be made for cancelling an agreement dated May 16, 1866, entered into between the Commissioners and the Wolverhampton New Water-Works Company, whose undertaking was transferred to the Corporation of Wolverhampton, and relieving the Corporation and the Commissioners from all liability thereunder, on such terms and conditions, and the payment of such compensation or otherwise, as may be agreed upon or prescribed by Parliament. The rights of the Corporation with respect to the supply of water within the district of the Commissioners are to be extinguished; but the subsisting mains and pipes are to be continued. All actions, suits, or other proceedings pending between the Corporation and the Commissioners in respect to any of the above matters are to be stayed; and arrangements will be made for the disposal of any moneys payable to the Corporation by the Commissioners under the provisions of the above-mentioned agreement or the intended Act. The other powers

to be applied for relate to the borrowing of money and the application of funds and revenues.

Bodmin Water.—The Bodmin Water Company intend to seek power to construct additional works, consisting of a reservoir and two pipe-lines, extend their limits of supply, and sell water in bulk. More capital will be needed; and Parliament will be asked to authorize the Cornwall County Council to contribute money to, or take and hold shares in, the Company, to such an extent as may be defined in the Bill, which may contain provisions as to furnishing a supply of water free of cost in lieu of dividends, and such other special and incidental provisions as may be necessary in relation to the contemplated contributions by the Council.

Brighton and Hove Gas.—The Brighton and Hove General Gas Company will apply for power to extend their limits of supply, so as to include West Blatchington, Hangleton, Poynings, and Newtimber, in Sussex, and to lay down the necessary mains and pipes. It is proposed to extend the present works, on a site adjoining them; and authority will be sought to purchase other lands by agreement. Provision will be made for the sale of gas in bulk within and beyond the limits; and for the manufacture, sale, or hire of stoves and other appliances. Additional share and loan capital will be applied for. Existing rates and charges are to be altered and readjusted.

Brighton Electric Lighting.—The Brighton and Hove Electric Light Company, Limited, intend to make application for power to produce and supply electricity for public and private purposes in the borough of Brighton and the parish of Preston. The Bill to be promoted for carrying out the above-named object will contain a provision for the transfer of the undertaking to the Local Authority, or any other body; and the Board of Trade are to be authorized to make such orders as they may consider necessary, determining or curtailing the powers of the undertakers.

Chatham Water.—The Chatham Corporation wish to be empowered to purchase the undertaking of the Brompton, Chatham, Gillingham, and Rochester Water Company, and to carry it on with all the rights and privileges now attaching to it. The Company is to be wound up. Provision will be made for the supply of water in bulk to local authorities and others, and for the sale of portions of the undertaking; also for the raising of the money necessary for the purchase.

Crystal Palace District Gas—The general scope of the Bill of which the Crystal Palace District Gas Company have given notice was set forth and discussed in the JOURNAL for the 22nd ult. (p. 893); but its provisions may be briefly recapitulated here. Power will be sought to raise additional capital by the creation of consolidated ordinary stock, with a sliding scale of dividend at a standard rate of 5 per cent., with an increase or decrease of 2s. 6d. per cent. per annum for every reduction or raising of the price to the extent of 1d. per 1000 cubic feet of gas. The new capital is to be offered by auction or tender to the general public, to the consumers in the Company's district, or to their employees, at the price of the day, or on any other terms which the Board of Trade, or such other authority as Parliament may appoint, and the Company agree upon. The existing 10 and 7 per cent. share capital, and the debenture stock, are to be converted into equivalent amounts of consolidated ordinary and debenture stock at 5 per cent., and the borrowing powers enlarged. All stock is to be transferable in sums of £5, or in multiples thereof. The qualifications of Directors are to be altered and enlarged; and the time for holding the half-yearly meetings changed. The remaining provisions relate to the authorization of amalgamation with other Metropolitan Gas Companies, to the alteration of the Company's Act of 1873 in respect to the quality of their gas, and to the proposed arrangement with the South Metropolitan Gas Company for the landing and delivery of coal, &c., at the jetty at East Greenwich.

Devonport Water.—The Devonport Water Company intend to apply for authority to make a line of pipes from their filter-beds and works at Brooklands, in the parish of St. Budeaux, to the Knackersknowle Road; to acquire certain lands and property; and to lay down mains, &c. The Company's limits of supply are to be defined and extended; and provision is to be made for the conclusion of agreements between the Company and Government, Local, and Sanitary Authorities, and others as to the supply of water. The Company are to sell water in bulk, or a portion of their undertaking, to the East Stonehouse Local Board; and arrangements are to be made for the supply of the Government establishments by the latter, and for the apportionment of the sums paid for such service. The existing powers of the Local Board in regard to rates and charges will be altered and enlarged. The other matters which will be dealt with in the Bill relate to the raising and application of moneys, the discharge of loans, and the amendment or repeal of Acts.

Dublin Corporation.—The Corporation of Dublin are desirous of obtaining the necessary authority for raising further money for carrying out the main drainage works sanctioned by their Provisional Order of the present year, and for the improvement and extension of the water-works.

East London Water.—The East London Water Company will seek power to raise by debenture stock additional capital not exceeding £500,000, to be employed chiefly in the purchase of land for the purposes of the Company's undertaking, and in sinking wells, constructing reservoirs, laying mains and pipes, and in generally enabling them to meet the increased demands for water within their existing limits of supply. It is proposed to extend the provisions of the Water-Works Clauses Act, 1847, and make further provision in regard to the removal of, injury to, or interference with, the fittings or property of the Company, and the prevention of waste, misuse, or undue consumption of water. An endeavour will be made to define the word "owner" in certain enactments. The Company have had trouble lately in connection with some lammas lands in their occupation, owing to the exercise of commonable rights in respect thereto; and these the Company will seek authority to acquire compulsorily or by agreement.

East Stonehouse Water.—The East Stonehouse Local Board are about to apply for authority to construct additional water-works, comprising a storeage reservoir (to be called the Cadaford reservoir), in the parishes of Meavy and Shaugh Prior, three lines of pipes, and the diversion of a road. It is proposed to take the waters of the Cad, or Plym, and to acquire lands and easements by compulsion or agreement. Permission will be asked to sell any portions of the existing works the Board may consider to be superfluous. More money will be needed for the above and other purposes.

Frimley and Farnborough District Water.—Application is to be made for the incorporation of a Company to construct works for the supply of water in the parishes of Farnborough, Crondall, and Yateley, in Hampshire, and Frimley and Ash, in Surrey. The works will consist of a pumping-station and a storeage reservoir near Sturt Junction, on the South-Western Railway, a service reservoir on Frith Hill, and three conduits or pipe-lines. Authority will be sought to take water from the Basingstoke Canal Company, the London and South-Western Railway Company, and the Surrey and Hants Canal Company; as well as to enter into agreements with the Aldershot Gas and Water Company, the Woking Water and Gas Company, and the Wokingham District Water Company, for the sale to the Frimley Company of water in bulk. Provision is to be made for the transfer on lease of the undertaking to the three last-named Companies, or any one of them; and also for the transfer to the Frimley Company of the powers acquired by the Woking Water and Gas Company under the Surrey and Hants District Water-Works Act, 1887. These changes will necessarily involve the amendment of the Acts affecting the various bodies named.

Goole and District Gas and Water.—Application is to be made by the Goole and District Gas and Water Company for power to acquire lands for the erection of new gas-works; the present works to be continued or removed. New water-works, comprising a pumping-station at Snaith, and a pipe-line in connection therewith, are to be constructed; and a road is to be made. Authority will be sought for the supply of electricity. Additional capital will be asked for. Provision is to be made for the purchase of the entire undertaking by the Goole Local Board, and for that body and the Aire and Calder Navigation to take shares in the Company; applying for the purposes their existing funds, and any others they may raise. An extension of time for constructing the Old Goole Water Tower will be asked for, as well as various general powers.

Greenock Corporation.—The Corporation of Greenock are about to apply for an extension of the municipal and police boundaries of the borough; and, in the Bill to be promoted for the purpose, provision will be made for enlarging the area of compulsory water supply, so that it shall be coterminous with the new limits, and for conferring upon the Water Trust all the necessary authority to recover rates and charges therein. Permission will also be sought to raise more money on account of the water undertaking.

Harrogate Corporation.—In a General Bill for which notice has been given by the Harrogate Corporation, authority will be sought to lay down plant for the supply of electricity; and Parliament will be asked to confer upon the Corporation all or some of the powers contained in the Harrogate Electric Lighting Order, 1891, and the Electric Lighting Acts, 1882 and 1888.

Imperial Continental Gas Association.—The Imperial Continental Gas Association intend to apply for a Bill to repeal so much of section 6 of their Act of 1884 as limits the amount to be borrowed by the Association, and to empower them to raise additional capital by borrowing, or by the creation and issue of debenture stock, perpetual or redeemable. The Bill will contain a clause to provide for the forfeiture to the Association of dividends unclaimed for a period to be fixed, or to be prescribed by Parliament.

Liverpool Corporation.—In a General Powers Bill of which notice has been given by the Liverpool Corporation, it is proposed to include provisions to enable them to raise money for the purpose of carrying out works for the supply of water in bulk outside their compulsory limits, or to employ in this way any of the funds they are authorized to raise for their water undertaking. They will also seek power to charge to capital account, and to borrow to the credit of the Chorley water account, the sums which already have been, or may hereafter be, expended for the extension or improvement of those works; and to make other provision with reference to this expenditure.

London County Council.—Among the provisions contained in a General Powers Bill of which notice has been given by the London County Council, there is one for the appointment by the Council of members of the Thames and Lea Conservancy Boards, and for the alteration and amendment, so far as may be necessary, of the provisions of the Acts relating to those bodies. The Council intend to apply for the necessary powers to enable them to carry out an installation of electric lighting on the Victoria Embankment and in the gardens thereon, as well as on Waterloo and Westminster Bridges, and in neighbouring places. An endeavour will be made to repeal section 38 of the Council's Act of 1890, section 70 of their Act of 1891, and section 3 of the London Water Act, 1892, relative to inquiries and negotiations by the Council, and to confer upon them powers for prosecuting any such inquiries and negotiations as to matters of local government as they may think proper.

Lynton Water.—The Lynton Water Company, Limited, are desirous of being dissolved and re-incorporated with additional capital powers. Authority will be sought to continue or discontinue any of the existing works, and to construct others, for the ordinary supply of water in Lynton and Countisbury, and its sale in bulk beyond the limits. Provision will be made for the transfer of the undertaking to the Lynton Local Board.

New Swindon Gas.—The New Swindon Gas Company, Limited, desire to be dissolved and re-incorporated, with power to supply gas in the parishes of Swindon, Stratton St. Margaret, and Rodbourne Cheney, in Wiltshire; to maintain and continue their existing works, and works connected therewith; to supply gas, meters, fittings, &c.; and generally to carry on their undertaking. Further capital will be applied for.

Plymouth Corporation Water.—The Corporation of Plymouth intend to apply for power to construct a reservoir (to be called the Burrator reservoir), in the parishes of Sheepstor, Walkhampton, and Meavy, with the necessary conduits and pipe-lines. The reservoir will be formed by means of two retaining walls thrown across the River

Meavy. Authority will be sought to acquire lands and easements compulsorily, and to levy rents, rates, and charges; also to raise more money on loan.

Pontypridd Local Board (Gas).—Authority is to be sought by the Pontypridd Local Board for the purchase of the undertaking of the Pontypridd Gas Company, and the vesting thereof in the Board. Any agreement or agreements entered into relative to the purchase are to be confirmed; and the Company is to be dissolved. The Board will ask permission to continue the existing works and erect new ones, and to supply gas in their own district and within certain limits to be defined, as well as, by agreement, beyond these limits. Additional money powers will be applied for.

Rathmines and Rathgar Water-Works Confirmation and Township Improvement.—The Rathmines and Rathgar Improvement Commissioners intend to apply for parliamentary sanction for certain works constructed by them in the county of Dublin, and now in use for the supply of water in the townships named; also for power to carry out other works, and relinquish some already authorized. Provisions are to be made for entering into agreements with the upper millowners on the River Dodder, for settling the matters in dispute between the Commissioners and Sir R. Heron, for storing the waters of the Dodder, and for the supply of water for compensation and domestic purposes. Further money powers will be sought.

Rochester Extension and Water.—The Corporation of Rochester notify their intention of applying for authority to extend the municipal limits and carry out other projects, including the acquisition of the undertakings of the Brompton, Chatham, Gillingham, and Rochester Water Company, and the Higham and Hundred of Hoo Water Company, which bodies are, of course, to cease to exist. Provision is made for the compensation of officers. The Corporation will ask for an enlargement of their limits, and for the general powers usually granted to suppliers of water. Authority for raising the funds required for the above-named purposes will be sought.

Runcorn Water.—The Runcorn Improvement Commissioners desire to purchase, compulsorily or by agreement, the undertaking of the Runcorn, Weston, and Halton Water Company, with authority to supply water in those townships. The Company will, of course, be wound up. Provision is to be made for a further supply of water to the Commissioners from the Liverpool Corporation. All the necessary powers in regard to the supply of water will be asked for, as well as additional money powers.

Sheffield Corporation Water.—The Corporation of Sheffield intend to apply for an extension of the time limited by their Act of 1887 for continuing the increased charge of 25 per cent. authorized, by the Sheffield Water-Works Act of 1864, on the several maximum water-rates leviable under the provisions of the Sheffield Water-Works Act, 1853; and also for a further extension of the period specified by the Sheffield Water-Works Act, 1881, for the construction of the Broomhead and Morehall reservoirs, and by the Sheffield Water (New Works) Act, 1867, for making the Wadsley reservoir.

South Staffordshire Water.—The South Staffordshire Water Company notify their intention of applying for power to construct two service reservoirs, with the necessary conduits and pipe-lines, in the township of Great Barr, in the parish of Aldridge, Staffordshire, and to apply their existing funds, and other moneys which they will seek authority to raise, in carrying out the works. The preference stocks are to be consolidated; and confirmation will be sought to an agreement made between the Company and the Stourbridge Water Company relative to the supply of water to the township of Wordsley. Application will be made to have altered or repealed section 38 of their Act of 1875, under which the Company are not to pay dividends exceeding 6 per cent., unless they charge rates under the Act of 1853 for domestic purposes in the former district of the Dudley Water Company; and section 38 of the South Staffordshire Water-Works Act, 1878, the effect of which is to extend and make applicable to the new share capital by that Act authorized to be raised, the provisions of the above-named section of the Act of 1875.

Staines and Egham Gas.—The Staines and Egham District Gas and Coke Company, Limited, are in some doubt as to the validity of certain preference shares of the Company; and they are about to apply for an Act to confirm their creation and issue, and, if necessary, to repeal, amend, or vary the trust deed of the Company, and their Provisional Orders of 1871 and 1881.

Staines, Chertsey, &c., Districts Sewage Board.—Application is to be made for the sanction of Parliament to the incorporation of a Joint Sewage Board for the districts of Staines, Chertsey, and other towns in the Thames Valley. It is to be composed of representatives of the urban and rural and sanitary authorities or local boards of the parishes or places within a certain area; and it is to have the necessary power to construct and maintain conduits and pumping, precipitating, filtering, and other works for dealing with the sewage of the districts under its supervision, and for preventing the discharge thereof into the Thames or its watershed. The requisite powers will be sought to raise money for carrying out the works, and to levy rates for defraying the initial and current expenses. It is proposed that the East London, Southwark and Vauxhall, West Middlesex, Lambeth, Chelsea, and Grand Junction Water Companies shall pay to the Board an aggregate sum of £8000 per annum; and, to the extent of their payments, three of the Companies—the East London, Southwark and Vauxhall, and Lambeth—are to be exempted from further payment to the Chamberlain of the City of London under their respective Acts of 1886 and 1891. These annual money contributions are to be employed by the Board in the construction and maintenance of the works intended to be authorized; and the amount to be paid by each Company, and the date of payment, is to be defined in the Act to be applied for. Compulsory powers will be sought for the acquisition of lands and hereditaments at East Molesey and Walton-on-Thames, which will be required for the proposed scheme.

Stirling Water.—The Stirling Water Commissioners propose asking for authority to acquire certain lands in the parish of St. Ninians adjoining one of their existing reservoirs, and to convert the site of the reservoir into a filtering area. Additional works are to be constructed for generally improving the water supply of the town; and power will be sought to sell water in bulk, levy rates and charges, &c. The provisions of existing Acts are to be amended in the above respects, as well as in regard to the supply of compensation water. Further borrowing powers will be applied for.

Stockton Corporation Gas.—The Stockton Corporation are proposing to apply for power to extend their limits of supply, construct new works, and raise more money. The definition of the borough limits is to be altered for the purposes of the Stockton Gas Acts.

St. Helens Corporation.—In a General Powers Bill which is to be promoted by the St. Helens Corporation, several provisions will be included in regard to the gas and water undertakings. Authority will be sought to manufacture gas on a piece of ground adjoining the existing works, and to purchase other land. With respect to the water undertaking, provision is to be made for the payment, out of the revenue, of the rent under the lease granted by the St. Helens Water Company to the Corporation, and for the purchase by the Corporation of shares in the Company. The St. Helens Improvement Act of 1869 is to be amended in various respects; one being to render owners of houses liable to water-rent in certain cases. Additional borrowing powers will be applied for.

Todmorden Local Board (Gas Purchases).—The Todmorden Local Board are about to apply for power to purchase the undertaking of the Todmorden Gas Company, and the private gas-works belonging to Messrs. Fielden Bros., Limited, and Messrs. Wilson Bros., Limited, in that town. Confirmation of the agreements already entered into for the purchase of these properties, and the vesting of them in the Local Board, will be sought. The Company is to be dissolved; and the necessary authority to carry on the combined gas undertakings, and supply gas, meters, and fittings within the existing limits, or such others as may be defined, will be asked for, as well as power to borrow the money required.

Weaver Navigation.—In a Bill to be promoted by the Trustees of the River Weaver Navigation, they will ask for authority to lay certain lines of water and gas pipes to connect with those of the Northwich Local Board and of the Northwich Gas Company respectively.

West Hampshire Water.—Application is to be made for the incorporation of a Company to construct works for the supply of water in Christchurch, Sopley, Ringwood, Brockenhurst, Lyndhurst, and other places in the county of Southampton. The well and pumping-station are to be situated close to Knapp Mill; and the service reservoir will be constructed near the summit of St. Catherine's Hill, Christchurch. There are to be two conduits or pipe-lines. All the usual powers will be sought; and provision is to be made for the sale of the undertaking to the Christchurch Corporation.

Wolverhampton Gas.—The Wolverhampton Gas Company desire to extend their limits of supply so as to include the parishes of Bushbury, Penn, and Codsall. An agreement entered into with the Birmingham Canal Company, and other agreements, are to be confirmed; and further provisions are to be made in regard to the supply of gas, both generally and in bulk to local authorities and others. The Horseley Field Works and other property are to be sold. The Company's Act of 1852 is to be repealed in so far as it relates to the number and qualification of Directors, and also as to the reserve fund; and other provisions are to be made, if thought fit. The present capital is to be converted and increased.

NOTICES OF APPLICATIONS TO THE BOARD OF TRADE FOR PROVISIONAL ORDERS (SESSION 1893).

Under the Gas and Water Works Facilities Act, 1870.

Bromyard Gas.—The Bromyard Gas Light and Power Company, Limited, intend to apply for permission to continue and extend their existing works, and to construct others on land specified, for supplying "gas, heat, power, or force" in Bromyard, Linton, and Winslow, and in any town, shop, village, or place adjacent thereto. General powers to break up roads and streets, lay mains, and levy rates, as well as to supply gas-fittings and other appliances, will be sought. The existing capital is to be defined; and further money will be required.

Hoylake and West Kirby Gas and Water.—The Hoylake and West Kirby Gas and Water Company are desirous of raising additional capital, part of which may be preference stock. The Order to be applied for will repeal or amend section 73 of the Water-Works Clauses Act, 1847, and section 13 of the Hoylake and West Kirby Water Order, 1887, as to dividends, and will make other provision with respect thereto.

Llandrindod Wells Water.—The Llandrindod Wells Water Company notify their intention of applying for powers, to raise additional capital, by the issue of new shares or by borrowing.

Llanfairfechan and Aber Gas.—Application will be made by Colonel H. Platt for authority to continue the works which now supply Aber with gas, with the rights, power and privileges usually granted in connection with gas undertakings; and also to acquire, by agreement or otherwise, such land as may be necessary, other than for the purpose of manufacture and storeage.

Maidenhead Water.—The Maidenhead Water Company are desirous of obtaining authority to extend their limits of supply so as to include the parish of Hurley, and such portions of the parishes of White Waltham, Wargrave, Ruscombe, Broad Hinton, and Whistley as lie to the north of the Great Western Railway; and also to raise additional capital.

Newent Gas.—The Newent Gas Company, Limited, seek power to maintain their existing works, construct new ones, and also works for the treatment of residual products, and generally to carry on the business of suppliers of gas. The capital of the Company is to be defined and regulated.

Newington Water.—The Newington Water Company, Limited, wish to be authorized to construct new works, comprising a well and pumping-station in the parish of Cottingham, in the East Riding of Yorkshire, and a conduit therefrom to the Beverley Road, where it is crossed by the boundary of Kingston-upon-Hull. Power to supply water in bulk will be sought, as well as additional capital.

Otley Gas.—The Otley Gas Company will apply for the necessary authority to supply gas in bulk beyond their present limits, and to purchase additional land for the purposes of their undertaking. Further borrowing and other powers will be included in their application.

Pocklington Water.—The Pocklington Water Company, Limited, are about to seek power to construct additional works, to acquire by agreement easements over certain land, as well as a spring, and to raise further capital. The proposed new works will be carried out in the parishes or townships of Millington, Ousthorpe, and Pocklington, in the East Riding of Yorkshire. The spring referred to is situated in the Givendale Valley, at Millington.

Poole Water.—The Poole Water Company desire to extend their limits of supply to parts of the tything of Kinson, and the parishes of Canford Magna, and Corfe Mullen, in Dorset. Additional works, comprising engine-houses, water-towers, conduits, &c., are to be constructed; and for these and the general purposes of the undertaking, further capital will be needed.

Portishead Gas.—The Portishead Gas Company, Limited, wish to be authorized to maintain and continue their existing gas-works, and erect others, and to manufacture and supply gas, meters, fittings, &c., in the parishes of Portishead and Portbury, and in other places; also to sell gas in bulk, open streets and roads, and levy rates and charges. The amount of capital is to be defined; and provision will be made for its increase.

Sheffield Gas.—The Sheffield United Gas Company intend to apply for power to construct and maintain additional works on a piece of land in the township of Brightside Bierlow, Sheffield; to alter the apparatus for testing the illuminating power of the gas supplied by the Company; to enable the Company to create and issue debenture stock, and to make provision for the application of the money received therefrom; to provide for the payment of interest on moneys deposited with the Company as security, and for the application of unclaimed dividends; and, so far as may be necessary or advisable for the purposes of the intended Order, to alter, amend, or repeal the powers and provisions of the Company's Acts of 1855 and 1866, and their Orders of 1882 and 1890; to vary or extinguish all rights and privileges which would interfere with, or be inconsistent with, the Order to be applied for; and to confer upon the Company all such other powers, rights, and privileges as may be necessary or expedient to carry into effect the before-mentioned objects.

Sligo Gas.—The Sligo Gas Company will ask for authority to raise additional capital, extend their limits, sell gas in bulk, and make and supply meters, fittings, &c.

South-West Suburban Water.—The South-West Suburban Water Company desire authority to raise additional capital by the issue of preference shares or by means of loans; and they will ask for power to convert into preference stock the whole or a portion of their unissued share capital. The Company's Act of 1883 is to be amended so far as may be necessary to allow of the above objects being carried out.

Swindon Gas.—The Swindon Gas Company, Limited, wish to be empowered to maintain and continue their works, and to manufacture and supply gas, meters, fittings, &c., in Swindon, to sell gas in bulk, levy rates and charges, and generally to carry on their undertaking. The capital is to be defined, and its amount fixed; and provision will be made for its increase.

Under the Electric Lighting Acts, 1882 and 1888.

Applications will be made under the above Acts for powers in regard to the supply of electricity for lighting and other purposes in the following places: Altrincham and Bowdon, Bridgend, Brighton, Colchester, Eccles, Hackney, Hammersmith, Islington (three Orders), Newcastle-on-Tyne, Newmarket, Partick, Reading, and Taunton.

NOTICE OF AN APPLICATION TO THE LOCAL GOVERNMENT BOARD UNDER THE PUBLIC HEALTH ACT, 1875.

Bideford Corporation.—The Corporation of Bideford intend to apply to the Local Government Board for authority to maintain, continue, and extend the works of the Bideford Gas Company, and to acquire all the Company's rights and privileges. Power will be sought to manufacture gas and residual products, supply gas and fittings in and beyond the borough, purchase lands, and levy rates and charges. The necessary permission to raise money on loan for the objects above stated will be asked.

Birmingham Gas Workers and the St. John Ambulance Association.—A meeting of the employees in the Birmingham Corporation Gas Department was held last Wednesday, when certificates gained by members of the St. John Ambulance Association at a recent examination were distributed. Alderman Pollack presided; and in addressing the meeting, he spoke of the very extended area over which the St. John Ambulance Association worked. The workmen at the Gas Department were perhaps more subject to accident than men in other employments; and therefore it was important that, in cases of emergency, they themselves should be able to render assistance, and so save life. Many of them worked at night, when doctors were not at hand; and the help which they might render was infinitely great. The attention of the Gas Department was called to the Association through an accident at the works involving loss of life, and, at the suggestion of the Coroner, the Corporation had provided stretchers at the four works. When it was brought forward, the department at once took up the idea of holding ambulance classes; and the result was one of which they should be very proud. The number of men who attended the classes, and the number who passed the examination, were very gratifying. At the Adderley Street works, 19 men attended, and 14 of them passed the examination; at Saltley, 25 attended, and 21 obtained certificates; at Swan Village, 33 attended, and 29 passed; while at Windsor Street, 30 men enrolled themselves, and 28 passed. This did credit to the men as well as to their teachers; and they might look forward to the attendances at the classes being still further increased. Alderman Pollack afterwards distributed certificates to the successful members.

MISCELLANEOUS NEWS.

THE ROYAL COMMISSION ON LABOUR.

Gas Workers and Sunday Labour.

At last Tuesday's Sitting of the Royal Commission on Labour—Mr. DAVID DALE presiding—some evidence was given with reference to Sunday Labour in Gas-Works.

The Rev. *J. Gritton, D.D.*, Secretary of the Lord's Day Observance Society, in answer to the CHAIRMAN, stated that in one day he visited three different gas-works in the West of England. At one works he found that, where they rested from carbonizing for twelve hours on the Sunday, they made up their fires every two hours. At another, where they rested twelve hours from carbonizing, they made up the fires three times; but, when he came to the Worcester Gas-Works, the Engineer said that he only touched the fires once during the twelve hours. He thought, if the better methods adopted in the one works had been introduced into the other two, there would have been no necessity whatever for the fires being attended three or six times during the twelve hours. There were certain methods which minimized the labour, and, where they were adopted, there was very little work needed on the Sunday; but where they were neglected, there arose a kind of convenience in employing more labour on the Sunday. He thought a great deal of work now done above the minimum necessary was done needlessly upon mere theories of the managers who directed the operation of the works. He would refer to one of the most complete gas-works in England, the most recently erected, and most perfect in all its arrangements—those at Leicester. The carbonizing work there on the Sunday was precisely the same as it was on the other days of the week. There were three shifts; and the work went on continually night and day—week-day, and Sunday. The yard work was not done on Sunday—that was, all the work of the engineers, and all the arrangements as to the distribution of gas through the town ceased on Sunday. The reason which the Engineer gave for carrying on the carbonizing work without any cessation on Sunday was that he thought it good for the men that they should not be entirely thrust out of their usual work, and be loitering about with nothing to do. He thought if the Sunday work could be dispensed with—and it certainly could be at the Leicester works, for their appliances were as perfect as any throughout the country—the theoretical views of the Engineer ought not to be permitted to be the cause of the work. There was another point to be considered; and it was that the payment of extra wages for work done on Sunday was a temptation to the men. At the Liverpool Gas-Works, the Engineer stated that he had extreme difficulty in getting rid of Sunday work, and that certain sections of the men were so determined to have it that they allowed the ties running through the retort-benches to get into a dangerous condition, and did not report the matter till late in the week. He had come to the conclusion that this was done because these men were determined to get Sunday employment, even though in doing so they were risking the safety of the works. The Engineer had only been able to overcome this tendency to increased Sunday work by appointing an officer under him to see that investigations were made at the proper time, and that reports as to all weak ties needing to be changed or attended to, should reach him at a fair time during the week. Another reason he adduced for this desire on the part of the men was that, by working on the Sunday, they could enjoy the greater opportunities there were for drinking on Monday. He thought that employers should not yield to the men in such instances. Some of the cases which had been brought before him appeared to spring from the fact that there was an insufficient number of men in the works. He was sure there were manufactories where the attempt was made to carry on the operations without an adequate supply of plant; and this came out very specially in connection with gas-works. They heard the plea constantly, "Oh, if we had more retorts, and more storeage room, we should be able to make all our gas in the six days of the week; and there would be no necessity for Sunday work." This point had come up in a great many places. Another excuse for work on Sunday was that it enabled the employers to supply at a lower cost to the public; and this was sometimes pleaded as the reason for carrying on gas-works during the 24, 18, or 12 hours of Sunday. It was quite true that gas might be produced somewhat more cheaply by working seven days in the week, instead of six. There was a certain amount of damage to the plant by letting down the heats, and also (he had it on authority that would hardly be questioned), if all Sunday carbonizing were to cease entirely, the additional cost of the gas to the public would be ¾d. to 1¼d. per 1000 cubic feet.

The CHAIRMAN asked whom witness proposed to mention as his authority.

Witness said he referred to a member of the Commission—Mr. George Livesey.

Mr. LIVESEY: When did I say that?

Witness: About two or three years ago.

Mr. LIVESEY observed that he did not remember it; but he might have said so.

Witness (continuing) said the small degree of economy, or cheapness, to the consumer which he had referred to was hardly sufficient to warrant the Sunday work which was carried on. Even if it were more than that, and amounted to 3d. or 4d. per 1000 cubic feet, it would not warrant it in that particular branch of industry.

The CHAIRMAN: Did your statement mean from ¾d. to 1¼d. per 1000 feet on all the gas that might be made in the year; or on the quantity produced during Sunday?

Witness said he meant upon the whole produce of the works—the whole consumption.

Mr. LIVESEY: Then I may say it is over the mark; it would not cost ¾d. per 1000 cubic feet on the whole of the gas, I am sure.

Witness said, that being so, it constituted nothing like an excuse for Sunday work.

Mr. LIVESEY: With reference to the case you referred to at Liverpool, of the men scheming to enforce the employer to have Sunday work, would not you be of the opinion that, in the majority of cases,

it is the employer who initiates the Sunday work, either the men acquiescing or being obliged to acquiesce?

Witness thought that, in the majority of cases, the responsibility rested upon the employers; but there were a certain number of cases, like that to which he had referred at Liverpool, where the employers were overborne by the determination of the men to have the Sunday work. He did not know that they were frequent; but he had met with some very sad instances. At Stockton-on-Tees, the Manager of the Corporation gas-works was a great friend of Sunday rest; and at former works where he had been, he had reduced it to a very low minimum. Therefore he (witness) was rather surprised to find when he visited Stockton, that a large amount of work was done on Sunday; and the Manager informed him that he had endeavoured to the utmost of his power to reduce the work, but had been thoroughly beaten by the men. They had got up cliques and coteries; and had secured the election on the Town Council of one or two men for the purpose of worrying the Manager to yield to their demands. The determination of the men was so great that finally he had to yield; and a considerable amount of work was going on there which he utterly abhorred, but which he was unable to stop.

Mr. LIVESEY: Of course, it might be the case that the men employed at the gas-works had, with a view to some modification in the conditions of service, exercised their municipal franchise in a particular manner, not necessarily in order to bring about something else?

Witness: Judging from the statement of the Manager and from what he gathered from the men themselves, the question of Sunday work was the one bone of contention.

Would your inquiries into the cost of Sunday work not go to show that, in the majority of cases, the men are either cheerfully acquiescent, or reluctantly acquiescent, and that it is the opinion of the employer that his business requires it—in other words, that the employer is the person who regulates the hours of labour in his establishment, and upon him rests all responsibility for the Sunday work that may be going on?—I think so. In many cases, a great deal of the Sunday work is done grumblingly by men who do not like to do it, but who would probably lose their employment, if they did not do it.

The Liverpool case, I think, must have been exceptional, because iron ties do not wear out every week. Is it not possible that you saw the Engineer when that had just happened; and therefore that it is hardly fair to take that as a general illustration?—The returns of ties needing care, or needing to be removed, were made every week to the Engineer; and it was the duty of the officer appointed to give his attention particularly to that, and to make his returns every week.

About the Leicester case, I am rather afraid that what you have stated about the Engineer there may give a wrong impression—that he is careless about his men. You said he made the remark that it was better for them to work on Sunday. I happen to know that his relations with his men are of a very satisfactory character. Is it not possible that the reason why they work on Sundays is due to the Corporation insisting on it, upon the ground that it would be expensive not to work?—My only knowledge is derived from the Engineer himself, who made that remark as accounting for the carbonizing work on the Sunday being precisely what it was on other days in the week.

Mr. TROW: You mentioned a dispute at the Stockton Gas-Works. Are you aware that the dispute at the works was not over Sunday work, but owing to the Manager discharging some men who were connected with the Gas Workers' Union.

Witness: I did not gather that either from the Manager or men.

But you referred to the men electing representatives on the Town Council to deal with that question. Now, with regard to the burning of the ties at Liverpool, who burns them?—The heat of the banks gradually weakens them, and makes them unfit for their purpose.

And the stokers are responsible for reporting to the foreman?—There is now a particular officer whose duty it is to make these reports.

Do you know who repair the ties?—The various mechanics or smiths connected with the works.

Then in all probability the stokers, who had burnt the ties would be deprived of their work on Sunday, because of the repairing of the ties?—While the ties were being repaired, there would be no work going on in that particular bank.

Therefore, the men who burnt the ties realized nothing by burning them, but lost their Sunday work; and the outside smith, who had nothing to do with the firing, obtained the work on Sunday?—I have not said that there was any deliberate burning or destruction of the ties. The ties perished in the ordinary course of being continually subjected to great heat. If the man who failed to report early in the week was a stoker, he gained nothing in the way of Sunday work by not reporting it; but if it was the duty of a smith to report, then, by postponing the repairs, he might get Sunday work.

Further evidence not especially affecting gas-works was given before the Commission adjourned.

THE PRICE OF GAS AT ACCRINGTON.

Some of the Large Consumers Refuse to Pay the Increase.

Matters in connection with the Gas Question at Accrington are assuming a serious phase. Several of the largest consumers have absolutely refused to pay the increase in price demanded by the Gas Company; and they are now threatened with having the gas cut off, and the whole of the pipes, works, &c., at their places, removed. It will no doubt be remembered by readers of the JOURNAL that, at the beginning of the quarter, the Accrington Gas and Water Company gave consumers notice that the price of gas would be increased by 5d. per 1000 cubic feet, and also that the proposal was received in a very hostile spirit by the Corporation, neighbouring Local Boards, and the Accrington and Church Co-operative Society, all of whom passed condemnatory resolutions. The Directors of the Gas Company were approached on the subject; but, in consequence of the increased cost of production, they were unable to see their way to alter the resolution. Then arose the question as to the legality of the notice given by the Company regarding the increase—that is, so far as it relates to the quarter just ended. The argument adduced was that, the Company having neglected to put the notice of the proposed increase on the gas bills, it could not be enforced. The legality of the notice has been considered by the Finance Committee of the Corporation; and Counsel's opinion is being obtained by them before the account is settled. Meanwhile, the smaller consumers have had to pay the increase; but the Co-operative Society, the Church Local Board, and other large users of gas decline to pay. As a result, the Gas Company are proceeding to enforce payment; and a letter has been received by the Co-operative Society's Committee, from the Company's Solicitor (Mr. C. Costeker), making application for an immediate payment of £15 16s. 5d., the balance of account of gas-rent owing by them to the Company, and stating that unless the amount was paid within seven days the supply would be cut off, and the pipes, &c., removed. It is understood that similar action will be taken against all those who refuse to pay the increase. Such is the feeling on the latest action, that, at a special meeting of the Co-operative Society to be held at once, a resolution will be submitted that the whole of the 5000 odd members of the Society shall stop using gas at their houses, and burn oil. At last week's meeting of the Church Local Board, the Clerk (Mr. Reddish) said he had received the bill from the Accrington Gas and Water Company which had an additional charge of 5d. per 1000 cubic feet for the gas used. The Board had not had any notice of the increase beyond what had appeared in the newspapers, and part of the quarter had then gone. Mr. Cooper asked if the Company had charged for the whole of the quarter. The Clerk said they had. Mr. Cooper thereupon moved that the bill be not paid. The Clerk said the Accrington Corporation were not paying the increase until Counsel's opinion had been obtained as to the legality of the notice. Mr. Cooper withdrew his resolution, and moved that the account be paid after the old rate. Mr. Pearson seconded the motion; and it was agreed to unanimously.

FATAL EXPLOSION AT THE BRADFORD GAS-WORKS.

Last Saturday afternoon, an explosion of a very serious character resulting in the death of one man, severe injuries to several others, and considerable destruction of property, occurred at the Valley Road Gas-Works of the Bradford Corporation. Next to those at Birkshall, these are the largest gas-works in the town; and they are situated close to the line of the Midland Railway. They comprise the usual buildings for the manufacture and purification of gas; and there are four holders. Beneath the yard are the tar-tanks, constructed of brick and concrete; and it was here that the catastrophe appears to have originated. Shortly after midday, when everything was going on much as usual, the workmen engaged on the premises suddenly found themselves in the midst of an upheaval which is described as resembling more the nature of a volcanic disturbance than an explosion. The yard covering the tanks was blown up with great violence, and masonry, brickwork, and general *débris* were forced upwards, and then subsided into a heap of confusion and ruin. Everything standing within 30 or 40 yards was overturned. A number of men were at work in the yard at the time of the explosion, and they were instantly overwhelmed in the ruins. Five of them were rescued, suffering from serious injuries; and one unfortunately succumbed a few hours after. He was a foreman, of the name of Joseph Milner—a man about 60 years of age. He appears to have received the full force of the explosion, as he was terribly injured about the head and face. All the men were immediately removed to the Infirmary and promptly treated; the names of the other four being Womack, Forrest, Wood, and Smith. Several workmen sustained slight injuries. A horse and cart, belonging to a Mr. Walsh, a coal contractor, which were in the yard at the time, were buried; the horse being instantly killed, and the driver blown into the retort-house. After the shock of the explosion had passed away, there were grave doubts as to whether a number of men had not been overwhelmed in the general ruin; but a hasty roll-call relieved uneasiness on this score—all the men being accounted for. The area occupied by the underground tanks was about 40 yards long by 20 yards broad. This was wrecked from end to end; while the solid masonry forming the tanks was split and demolished as if it were the merest rubble. The immediate effect of the explosion upon the gas supply of the town was to virtually reduce the producing power by about one-fourth. Messages were sent to the other works of the Corporation, and measures were promptly taken to keep up the service; but, of course, it will be some days before the full quantity of gas can be produced. In the meantime, arrangements will be made so as to obviate, as far as possible, public inconvenience. No estimate in figures of the actual monetary damage caused by the explosion can at present be formed. There has been no serious explosion at any of the Bradford Gas-Works since 1879, when one occurred at the works in Thornton Road, causing the death of two men. With regard to the injured men who were removed to the Infirmary, the report on Sunday was that they were doing as well as the medical attendants could expect. Womack, Forrest, and Wood were detained there; the man Smith having sufficiently recovered from the shock to be removed home. A large staff of workmen have since been engaged clearing away the wreckage—a task which will necessarily occupy a considerable time.

The United Kingdom Economic Gas Syndicate, Limited.—A Company has been registered under this title, with a capital of £10,000 in £1 shares, to carry into effect an agreement entered into to purchase certain inventions specified therein, and the patent and other rights obtained in respect thereof, and to conduct the business of ironfounders, mechanical engineers, and manufacturers of tools, implements, and other machinery.

Sales of Stock and Shares.—Messrs. Alexander, Daniel, Selfe, and Co. offered for sale at Bristol last Thursday, £20,000 of 7 per cent. maximum ordinary stock in the *Bristol Water-Works Company*. There was a fair attendance of purchasers; and between £15,000 and £16,000 of the stock was disposed of, at prices ranging from £135 to £136 10s. per cent.——£10 shares in the *West Cowes Gas Company* changed hands last Thursday at £15 10s. each.

INCANDESCENT GAS-LIGHT COMPANY, LIMITED.

The Adjourned Fifth Annual Meeting of this Company was held last Thursday, at the Cannon Street Hotel, E.C.—Admiral Sir EDWARD INGLEFIELD, K.C.B., in the chair.

The SECRETARY (Mr. L. de Fonblanque) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the accounts for the fifteen months ending March 31 last (on which date it is proposed that the financial year shall end in future). The profit-balance shown on the trading account was £265.

The CHAIRMAN, in moving the adoption of the report and accounts, explained that the unusual delay in submitting the accounts had been occasioned owing to the Directors being of opinion that it was not advisable to publish them until pending negotiations for the sale of certain patents had been brought to a definite conclusion. They had now much pleasure in informing the shareholders that the French patents had been sold on terms which could not but be considered highly satisfactory. The price obtained was £12,000, of which £4000 was in cash, and the balance in shares. The Directors believed that, after a year's working, the shares of the French Company would have advanced largely in value, and would realize considerably more than the nominal amount. The Belgian patent had now been sold for £2000 in cash, and £8000 in shares. In both cases a certain number of shares had been allotted by the Company to the promoters and others; but the profit on the sales was very gratifying. The result of the past fifteen months' working was not satisfactory; but the Directors were anticipating a brighter future. The business done during the period mentioned had been very small; but he could give an explanation of this. In August of last year, the Directors informed the shareholders that Dr. Auer von Welsbach had practically completed a process, by means of which he could make a lighting fluid with which to impregnate the mantles, with the result that the mantle, instead of giving a light of 25 to 30 candles, would give from 60 to 80 candles, according to the form of burner and chimney used. In addition to this, the mantles would have a considerably greater lasting power than those hitherto used. The Directors had every reason to believe that they would have obtained this fluid in such quantities as they might require at the commencement of the winter season of 1891. Relying upon this, they made no efforts at the beginning of that season to push the sale of the old mantles, in order not to spoil the effect of the new system. The measures they took to place the new light before the public proved exceedingly satisfactory. But, unfortunately, they had no fluid to enable them to execute the large orders received from their agents; and it was close upon Christmas before they could issue mantles of the new pattern. The subsequent consignments of fluid, too, were quite inadequate to meet the demands; and the Directors were well aware of the heavy loss the Company had sustained owing to their inability to supply in sufficient quantities. There was, however, one element of satisfaction in this. The lamps supplied gave such good results, and so commended themselves to the public, that this season they were reaping the benefit—the sales for the last three months having been from four to five times as great as in the corresponding period of last year. A new branch of business which they hoped to develop was in gas-making machines, which were the inventions of their General Manager (Mr. Moeller). One of these was the "Helios" gas-making machine, which was introduced at the beginning of last winter, and which they had since considerably improved in many small details. They had disposed of a large number of these; and the system was making its way, and was getting known throughout the country. They had also rights in connection with a petroleum gas-making machine, which was extremely simple in its working, and very effective and economical. The advantage of this machine was that the gas was made from crude petroleum, which could be bought at a price so low that the gas made from it cost approximately the same as coal gas, while its illuminating power was four times greater. Another great difficulty with which they had to contend last winter was the lack of capital, by which they had always been hindered, and which prevented them from developing the business to the best advantage. Last autumn they made an issue of debentures; but it met with very little response on the part of the shareholders. They practically offered £10,000 worth of debentures and preference shares, and received applications for only £1200 worth. For the purpose of pushing the sale of the gas-making machines, and for introducing the new light, it was absolutely necessary to have £5000 or £6000 at command. In these circumstances, the Directors considered what could be done to save the Company; and it was thought advisable to discount the bills which were held on account of the sale of the Italian patent. Owing, however, to the long date of these bills (which were not due until July and November next), the Directors found it was quite impossible to discount them on ordinary terms; and, under these circumstances, so convinced were they of the better prospects of the Company, that they gave their personal and individual security. The scheme for the reduction of the capital as passed by the shareholders had obtained the sanction of the Court, and had been carried into effect. Before concluding his remarks, the Chairman received a telegram from the General Manager (who is abroad), saying: "Sold Belgian shares at par, £6000. Spanish patent sold firm, cash £6000. Indian patent sold £1000, without oil-gas arrangement. . . Italian business secured. Prospects now excellent."

Major C. JONES seconded the motion.

The CHAIRMAN, in reply to a question, stated that the Company could now themselves produce any quantity of fluid required for the mantles quite as good as Dr. Auer.

Mr. MACTEAR thought the shareholders were highly indebted to the Directors who were now controlling the business of the Company for what they had done for them. He referred to the early troubles of the concern, the true secret of which was, he believed, that they had great difficulty in procuring at least one of the elements required to obtain a good light. He had recently been in Vienna and Paris; and he was surprised to see the rate at which the lights had been taken up. Something like 10 per cent. of the shops were now lighted by Dr. Auer's system; and during the last 18 or 20 months, the number of lights visible had at least doubled. He thought the shareholders would now see that, at the time he was Managing-Director of the Company, he had many difficulties to contend with; and he hoped that a great deal of the blame which was thrown upon his shoulders would now be removed.

The CHAIRMAN observed that it was due to Mr. Mactear to say that, before he rose to address the meeting, he (the Chairman) had made a note on the *agenda* paper to the effect that the thanks of the shareholders were due to that gentleman for the information and assistance he had given to the Company; and the Directors wished to publicly announce that the charges made against him were entirely unfounded.

The motion was unanimously carried.

The Chairman, who was the Director retiring by rotation, was re-elected; the appointment of Major-General Beresford, in place of Mr. Williams, who had resigned from the Board, was confirmed; and Messrs. Cooper Bros. were elected Auditors—Messrs. Price, Waterhouse, and Co., having also resigned.

A vote of thanks to the Directors terminated the proceedings.

SINGAPORE GAS COMPANY, LIMITED.

An Extraordinary General Meeting of this Company was held last Wednesday, at the Cannon Street Hotel—Mr. R. S. FOREMAN in the chair.

The SECRETARY (Mr. R. M. Christie) read the notice convening the meeting; and the Directors' report and the accounts for the half year ending June 30 last (see *ante*, p. 961), were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that at the meeting of the shareholders held in April last, it was stated that the Directors, for reasons which were fully explained at the time, were not in a position to recommend the declaration of a dividend; and the shareholders, with that consideration which they had always shown in times when the business of the Company had received a temporary check (although, of course, naturally disappointed at not receiving their usual dividends), concurred with the views entertained by the Directors on that occasion. With regard to the half year now under consideration, the accounts showed an available balance of £1368; and this amount would have been much increased had it not been for the heavy drawbacks that had taken place during the past six months, the first of which in importance was the serious further decline in the exchange. The average rate for the half year was only 2s. $11\frac{7}{16}$d. per dollar, as compared with a rate of 3s. $3\frac{5}{16}$d. for the corresponding, and 3s. $2\frac{9}{16}$d. for the previous half year. This had increased the loss on exchange by the sum of £497 over the June half of 1891, and of £937 over that of the December half of that year. He might say roundly that the loss on exchange now amounted to about 6 per cent. on the fully paid-up capital. While on the subject of exchange, he would call especial attention to the serious loss they had sustained in the public lighting department. When the existing contract with the Municipal Commissioners was first entered into in 1878, the value of the dollar was about 4s.; and the price was then considered a very fair and equitable one by the contracting parties. But, in consequence of the altered condition of the exchange—the value of the dollar being now a little over 2s. 9d.—the price they now received per 1000 cubic feet of gas consumed was much lower than that obtained by the Metropolitan Gas Companies; and taking into account the extra cost of manufacturing gas in Singapore, instead of being less, it ought to be considerably in advance of the price paid to the London Companies. By the recent failure of the New Oriental Bank Corporation (who were indebted to the Company to the extent of £550 on bills of exchange negotiated by their Manager through the branch establishment of that bank at Singapore for transmission to London), they had sustained a further loss. They had dealt with this by transferring £250 from the contingent fund to write down this amount; leaving £300 on the credit side of the balance-sheet as the snm they would probably eventually recover. Salaries and travelling expenses had been increased by about £400, occasioned by the recent change in the management; but these were quite exceptional charges, and would not appear in future accounts. He might say that their late Manager (Mr. W. T. Batten), who was a shareholder to no inconsiderable amount, was present, and would perhaps give the shareholders his views on the situation. The sound and excellent condition in which the works, plant, mains, &c., were left when Mr. Batten retired from office enabled the Directors to believe that the expenditure for some time to come for renewals and repairs of mains, &c., would not be of a very heavy description; and they therefore hoped that they might be in a position to maintain for the current half year the dividend at the rate of 4 per cent. per annum now recommended for the past six months. They could not, however, hold out hopes of any great improvement in the immediate future, especially if the adverse rate of exchange continued as low as at present.

Mr. S. SPENCER, in seconding the motion, said he could not help saying that, when the Directors appealed to the shareholders last year to take up new shares, there was not the response there ought to have been, considering that the best endeavours of the Board had been used in pulling the Company into more successful working order. If they had only obtained what they asked for—10 per cent. *pro ratâ* was a very small proportion—the shareholders would not have missed their dividend last year, because it would have given the Directors the necessary funds to carry on the business—to pay promptly for the goods received, which was most essential in their case; for unless they could do that, they could not go into the market to buy on the best terms. If at any time they should want more capital, he hoped the Directors would receive the hearty support of the shareholders.

Mr. RICE said it had been suggested that the shareholders might get their dividends over from Singapore in produce; and he could not see that there would be any difficulty about it. He supposed, if shareholders chose, the dividend could be paid to them in dollars at Singapore; and then they could combine and agree with London merchants to purchase produce, and so get the money over in that way. Of course, small shareholders could have their money as at present; so that they would not be worse off than now.

The CHAIRMAN observed that the payment of the dividend in Singapore would make no difference, because the dollar was only worth

the same there as here. So far as the Company was concerned, the purchase of produce, as suggested, would be *ultra vires* altogether.

Mr. SPENCER remarked that if shareholders gave the Directors instructions to do so, the dividends could be paid to any bank or merchant at Singapore.

Mr. DYER congratulated the Directors upon the improved state of affairs. He saw the Directors were endeavouring to cut down the debts; and he thought that was a good sign. What they really required was a lower amount of capital per ton of coal carbonized; and he thought every shareholder would be perfectly satisfied with 4 per cent. for some time to come if the Directors continued to show they were reducing the debt. He presumed the item "sundry creditors £6777," was really borrowed money. As to Mr. Spencer's remarks, he thought perhaps, in one sense, it was a good thing the shareholders did not take up the debentures, because probably they would then have had a dividend last year, but instead the money had gone to pay off some of the debts.

The CHAIRMAN stated that the item of "sundry creditors" represented bills for coal, &c.; and the amount had now been reduced to £4751. The great drawback, he added, to the Company's progress was no doubt the rate of exchange. Upon the sum of £3700 sent over in the shape of remittances, the loss amounted to £1937—being more than one-half the actual amount received.

The motion was unanimously carried.

The CHAIRMAN then proposed the declaration of a dividend for the past half year at the rate of 4 per cent. per annum, less income-tax.

Mr. B. GREEN, in seconding the proposition, mentioned that there had been the satisfactory increase in the gas and meter rental of something like £600, compared with the corresponding period of last year; but, unfortunately, the residual sales were less by £167, owing to the depression of trade in Singapore.

The proposition was carried.

Mr. BATTEN, having been invited by the Chairman to address the meeting, said he must first express his regret that he was not able to remain at Singapore until after the new municipal contract was concluded; but family matters had necessitated his return to England. However, before he left Singapore, Mr. Smith (their new Engineer and Manager) had been there for about three weeks; and they had ample opportunities for talking over the matters connected with the renewal of the contract. Their ideas were the same; and he was sure that the matter of the contract, as well as all other questions, were perfectly safe in Mr. Smith's hands. With respect to the increased discount which they allowed consumers, anyone who had had experience in gas matters knew that the lowest remunerative price was the best, and would eventually, if not immediately, lead to a growth of business. It was at his suggestion, and after some pressure on his part, that the Directors agreed to the extra discount; and he felt sure that, in the course of time, it would pay the Company well. The gas consumed for public lighting was sold at a very low figure—much lower than in other towns in the East. They were receiving only 2s. 9d. per 1000 cubic feet; and when they considered that this was for gas of 16-candle power, he thought they would agree that the Municipality were being well served. During the nine years he was at Singapore, he had never had a complaint as to the purity or the illuminating power of the gas supplied for public lighting; and although the Municipality went to the expense of having it tested by one of the chief officials for a certain time, it was invariably found far above the contract rate, which was only 14 candles. He would like to say here that the Municipality appreciated the way they were served; and the Company never had any trouble with unnecessary complaints—on the contrary, the chief officers and all connected with the Municipality treated them in a very fair and liberal spirit. As far as private consumption was concerned, it was perfectly impossible to consider private lighting abroad—particularly in the tropics—from the same point of view as people connected with English gas companies would do. To begin with, the length of mains and services was much greater than in England; and another thing was that people did not remain in the same houses so long as they did in this country. There were many more changes in the tropics; and people did not consequently care to go into expense which here would be thought nothing of. Each new consumer was only procured by really hard work, or by people coming to the colony with a preference for gas; but they generally adopted the cheapest form of illuminant. Another difficulty under which all foreign gas companies worked was the high price of coal. The price varied considerably in Singapore; but he did not think that, compared with many other places abroad, it was dear, though it was much more so than in England. They had no sale for ammoniacal liquor or sulphate of ammonia; but, as a rule, they had a fair demand for tar. Unfortunately, however, during the past three months it had unavoidably fallen off, owing to a large quantity having been imported into the colony. As to the suggestion with regard to the curtailment of the capital, the Directors, of course, had this in view. Mr. Rice's proposal with respect to the dividends he thought was decidedly novel; but it was entirely a question for the shareholders themselves, and not for the Directors. It was pleasing to say the concern was undoubtedly advancing. The capital was slowly being reduced; and there were only two things they had to look forward to to make the Company much more prosperous—the renewal of the public lighting contract, and an improvement in the rate of exchange. In reply to questions, he added that there was practically no scope for gas-stoves at Singapore; and inquiries he had made with other gentlemen proved it was impossible to get better returns from the residuals by working up the ammoniacal liquor.

The usual complimentary vote having been passed to the Chairman and Directors,

The CHAIRMAN, after briefly acknowledging it, proposed that a vote of thanks be accorded to the present Manager (Mr. H. W. Smith), in whom the Directors placed every confidence, for the zeal and ability he had displayed in attending to the business of the Company during his short residence in Singapore.

Mr. BATTEN seconded the motion, and it was carried unanimously.

Votes of thanks were also passed to Mr. Batten, to the Auditors (Messrs. Magnus Ohren and T. Guyatt), and to the Secretary, who, the Chairman remarked, had carried out his duties in every way satisfactorily to the Directors.

EXTENSIONS AT THE COLCHESTER GAS-WORKS.

During the past two seasons, very considerable alterations and extensions have been made at the Colchester Gas-Works. The town and trade have increased so much of late years, that the manufacturing and distributing plant had become quite inadequate to supply the large demand made upon them. The Directors therefore decided to do all that was required to put everything into a thoroughly efficient state; and they instructed their Engineer (Mr. H. S. Pike) to prepare a report, with estimate and drawings, as to what would be necessary. The scheme he proposed was adopted; and it has now been carried out, with the exception of certain extensions to the retort-house and the gasholder. These, however, will have to be undertaken before long, as the storeage is only equal to half-a-day's consumption in the heaviest part of the winter; and the whole of the retorts will probably be in use during the present season. The first thing done was to take out all the connections through the works, and replace them with 16-inch pipes. The retort-house has been overhauled, and 28 new retorts provided—filling up the vacant space in the house; and five arches, containing 70 retorts, were also taken down, and rebuilt upon modern lines. In order to improve the condensation, a new foul main has been carried round the house, and one of Messrs. Morris and Cutler's patent condensers of a million cubic feet capacity, adopted in place of the smaller annular condenser. The scrubbers have been enlarged and re-arranged; and one of Messrs. Kirkham, Hulett, and Chandler's washers, of the above-named power, placed after them. Both the sets of purifiers have received attention; and the valves have been altered so that all the purifiers can be used at the same time, or part of them thrown out of use for cleaning, &c. The old station meter had to be removed to make way for a governor. As this was working to its full capability, it was replaced by a new one of 50,000 cubic feet capacity. The old meter-house is converted into a governor-room, and contains one 24-inch and one 12-inch governor. The meter and governors were supplied by the Gas-Meter Company, Limited. The old intermittent sulphate plant has been removed; and a new 20-ton continuous plant put down complete, with Wilton's saturator and discharger. It was furnished by Mr. Maurice Schwab, of Manchester. A new coal-store has been erected on one side of the proposed new retort-house. This will contain rather more than 3000 tons of coal. This is brought to the works by vessels; and it used to be lifted out by means of a steam-crane into trams, which were discharged by hand from the ground-level of the stores—necessitating the trimming of the greater part of it in the store. A difficulty presented itself in dealing with the coal-delivery, as the roadway had to be crossed, and the authorities would not sanction the erection of a tramway overhead, unless it was carried a certain height. This was not convenient for the coal-stores; so the old tramway at the road-level had to remain, and the coal hoisted at the entrance of each store. Several methods of dealing with this were considered; and hydraulic power was selected for the purpose. An overhead gantry has been erected in the roof of the stores, and at each entrance there is placed a hoist, into which the trams run, and are lifted to the level of the upper gantry. The trams are then moved to any desired position in the stores, and there discharged. A new hydraulic crane has been fitted up at the quay side; and vessels can now be discharged in a single tide, instead of waiting perhaps four or five days. The hydraulic plant has been supplied by Tangyes Limited, of Birmingham. Hydraulic power is also applied to the new coke-breaking machinery, for the purpose of lifting the coke to the mill. Two new steel Cornish boilers for high-pressure steam have been provided. It was also thought desirable that the Company should be in a position to do any repairs to the engines or machinery; and for this purpose a new mechanics' shop has been made, and fitted with the necessary engine, lathes, and other machines. To make the works complete, a new laboratory has been provided, fitted with all the most modern appliances. While the works have been thus improved, the distributing plant has been thoroughly overhauled. The leading main from the works was, for 3000 yards, 16 inches and 14 inches in diameter. This has been taken up and replaced with 24-inch pipes; the old 16-inch mains being used to replace about 1500 yards of 12-inch and 10-inch pipes. The town now receives an ample supply of gas in all parts. The whole of the work has been exceedingly well done; and by carrying it out, provision has been made for a large increase in the consumption of gas, the price of which, the Directors hope, with a cheaper market for coal, to be able shortly to reduce.

Preventing the Inspection of Water-Fittings.—At the Worship Street Police Court last Thursday, Robert Rayner, carrying on business at 20 and 22, Elder Street, Norton Folgate, was summoned for contravening the East London Water-Works Act, by preventing an officer of the Water Company from entering and inspecting the fittings for the water supply on his premises. The Company's inspector had on four or five occasions tried to get on to the premises, but had been prevented; defendant saying he was too busy to be troubled. Mr. Bushby imposed a fine of £5 and 2s. costs. The money was paid.

The Work of the Labour Commission.—To-morrow Committee C of the Labour Commission will hold a sitting; and the Commission will not meet again till Monday, Jan. 24, 1893. It may therefore be interesting to review the work done. Up to the present time the Commission has met for the taking of evidence, as a whole, 13 times; Committee A (iron and coal), of which Mr. David Dale is Chairman, 49 times; Committee B (docks, railways, and agriculture), of which Lord Derby is Chairman, 47 times; and Committee C (textile and miscellaneous), over which Mr. Mundella presides, 43 times. Altogether, 566 witnesses have been examined—22 before the whole Commission, 157 before Committee A, 171 before Committee B, and 216 before Committee C. In addition to this, the Assistant-Commissioners have held local inquiries into the conditions of agricultural labour in various parts of the country; and the lady Commissioners have examined into the conditions of female labour in various industries. The results of their investigations will be embodied in reports to the main Commission.

SMETHWICK LOCAL BOARD GAS SUPPLY.

Local Government Board Inquiry.

Last Thursday, Mr. E. P. Burd held an inquiry at the Public Buildings, Smethwick, with respect to an application made by the Smethwick Local Board for a Provisional Order to partly repeal, alter, or amend the Smethwick Local Board (Gas) Act, 1876, and the Local Government Board's Provisional Orders Confirmation (No. 3) Act, 1882, so as (1) to make better provision with regard to the borrowing and repayment of loans, (2) to provide that it shall not be necessary for the Local Board to file a copy of their yearly gas accounts with the Clerk of the Peace for the County of Stafford, and (3) to enable the Local Board to raise money on loan for the purpose of providing working capital for their gas undertaking. Among those present were Messrs. J. Newey (Chairman of the Board), W. Shakespeare (Clerk), W. J. Sturges (Secretary to the gas undertaking), and B. W. Smith (Manager). Mr. Shakespeare explained that the Act under which the Smethwick Local Board derived their powers for making and supplying gas was passed in the year 1876; and it enabled the Board to purchase the undertaking from the Birmingham Corporation. The gas was not, however, manufactured in Smethwick, but either at West Bromwich or in Birmingham; so that, under the Act, what the Board had really acquired was the distributing plant without the supply. They obtained land and erected gas-works; but the Board did not commence to make gas until October, 1891. Under the 20th section of the Act, they had power to borrow £56,090 towards the cost of the purchase of the gas undertaking, the amount of which was ascertained, under the provisions of the Act, by arbitration. In addition to being able to borrow the money to pay the Corporation, they had permission to raise such other moneys, not exceeding £50,000, as they might require from time to time. In 1882 the Local Government Board's Provisional Orders Confirmation Act was passed; and it enabled the Local Board to borrow £75,000—making altogether £125,000, the amount necessary to pay the Birmingham Corporation. Neither the Act of 1876 nor the Provisional Order of 1882 authorized the Board to raise any money for working capital. Since they had commenced the works, they had not had any working capital of their own; and they had had to borrow various amounts, ranging from £6000 to £600, from the Treasurer. Last year they owed him £3276; and they had stock in hand valued at £4128. From the year 1876 up to the present time, they had on several occasions had to extend the gas-works in order to satisfy the requirements of the population, which was increasing. In 1882 the total quantity of gas manufactured was nearly 124 million cubic feet, as against 154 millions in 1891, which was a considerable increase. The sales of gas to large consumers in 1882 reached 62 million cubic feet, as compared with 73 millions in 1891; to ordinary consumers they were 44 millions in 1882 and 57 millions in 1891. The gas supplied for public lighting in the same period had risen from 9 to 15 million cubic feet. The Board had erected the works five years before they commenced making gas; and they did not derive any benefits during those years. Application was made for an extension of the period for the repayment of the borrowed money. They now wanted to raise the sum of £14,000 for working capital. During the year they had made certain alterations at the works, which had enabled them to go on more successfully. The improvements would cost £9000; and it was absolutely necessary that the Board should have working capital. In reply to the Inspector, Mr. Shakespeare stated that the total profit made on the gas undertaking was £11,301; and the losses, £2866—leaving a surplus of £8435. The amount outstanding on sanitary loans was £78,283; and on gas loans, £153,203. The assessment of the district was £110,000; and the population at the last census was 36,107. This was the principal evidence submitted; and the Inspector promised to report the result of the inquiry to the Local Government Board.

A GAS CONSUMERS' CONGRESS.

Under the title of "A Strange Congress," reference was made, in our editorial columns on the 27th of September last, to a proposal to hold at Lyons a congress of gas consumers from every town in France desirous of taking part in it, with the view of settling on some course of action to redress their grievances—real or imaginary. Seeing that the conditions under which gas companies across the Channel carry on their operations vary with the localities, it is difficult to see how any general resolutions could have any effect; and unless there were some prospect of enforcing the views of the representative consumers, there would appear to be little use in holding a meeting to express them. However, the projectors of the gathering evidently thought they ought to make it look as important as possible, so they issued a circular setting forth the questions to be submitted for discussion at the congress, which was fixed to take place on the 27th ult. An epitome of the document, the full text of which is given in the current number of *Le Gaz*, may not be uninteresting to our readers. In the first place, the object of the congress was to consider all matters bearing upon public and private lighting, in order to secure better terms for the consumers. The clauses and conditions of existing concessions were to be discussed, with the view of ascertaining what means could be employed to obtain a reduction in the price of gas. Then seven definite questions were to be brought forward. In the first place, the importance of lighting and heating, from an economical and social point of view, and the rights and responsibilities of consumers were to come under review. Next, gas was to be regarded in its threefold character of illuminant, heating medium, and agent of motive power; and subsequently its price, and the best practical means of obtaining a reduction thereof, were to be debated. In this connection, the questions of the right to the use of the subsoil of the national roads for main laying, the competition of electricity and mineral oils with gas, and the strict execution of all the clauses and conditions of treaties, were to be noticed. The remaining subjects to engage attention were the undertaking of public and private lighting by municipalities; monopolies, their constitution and defects; and the vexatious and improper clauses contained in conditions under which concessions are granted. It will be seen, from the foregoing outline of the arrangements, that plenty of discussable matter was provided for the congress. How it was dealt with, and what will be the effect, are questions upon which we shall have to await information from some of our French contemporaries. It should be added that the list of officials constituting the Gas Consumers' Strike Committee is formidable; comprising a President, two Vice-Presidents, two Treasurers, and three Secretaries.

THE BRIGHTON CORPORATION AND ELECTRIC LIGHTING.

Projected Electric Lighting of the King's Road.

At the Meeting of the Brighton Town Council last Thursday, an important report was presented from the Lighting Committee. It contained, first of all, a recommendation that the Council should confirm the resolution come to on the 31st of October last (see *ante*, p. 824) as to the extension of the Corporation area. Then came a report from the Manager of the electric lighting works of the Corporation (Mr. A. Wright), in regard to the projected lighting by electricity of the whole of the sea-front, from the western boundary of the municipal borough to the Aquarium. Mr. Wright proposed to employ 40 arc lamps (20 on either side of the roadway) from dusk till 11 p.m.; and, after that hour until dawn, 16-candle power incandescent lamps, placed under enamelled reflectors, on as many of the existing 95 gas-lamp standards as might be considered necessary. He thought the addition of a third wire to the present mains offered the best solution of how to economically supply the proposed arc lamps, as they could then, he said, be served from the feeding-points in the neighbourhood, without interfering with the distribution of pressure in the ordinary mains. The incandescent lamps could be fed from the same points. Proceeding to give details, Mr. Wright said: "The above-mentioned 40 arc lamps will consume nearly 30,000 units per annum, amounting, at 7d. per unit, to £875; and the cost of the incandescent lamps, from 11 p.m. to dawn, will be £337—making the total cost of lighting the part of the sea-front described about £1212 per annum. This will be £290 per annum in excess of the present cost of gas; while the amount of light between dusk and 11 p.m. will be nearly five times as great, and after 11 p.m. will exceed that at present derived from gas." He went on to remark that, for the purposes of this supply, additional plant would have to be laid down; and the best form it could take would be two sets of very high discharge storeage batteries, to meet the requirements of early and irregular customers, and a 30-horse power dynamo for the general increase of the demand. The total cost of the scheme would be £11,985. In commenting upon the report, the Committee pointed out that, apart from the capital outlay, the charge upon the district fund would be only £1212 per annum. They recommended "that the suggested alteration be carried into effect; that notice be given to the Brighton and Hove General Gas Company to terminate, on the 24th of June next, so far as relates to the King's Road, the contract with the Company dated the 31st of October, 1890, for the supply of gas to the street lamps on the King's Road and Marine Parade; and that application be made to the Local Government Board for sanction to borrow £2700, for a period of 30 years, to defray the cost of the new lamp-columns, lamps, and appliances." Next came a report from Mr. Wright with regard to the new mains, plant, and machinery immediately required to meet the increasing demand for the supply of electricity from the works of the Corporation, and for the proposed extension of the business, and as to the additional capital necessary for these purposes. After giving details as to the plant, he summarized the expenditure recommended, which amounted altogether to £33,332. Adding £1668 for contingencies, he made a total of £35,000, exclusive of the £2700 debited to the district fund account in respect of the King's Road scheme. The Lighting Committee also submitted their financial statement for the current year. They explained in regard thereto that, in the report presented to the Council on Oct. 31 last, they pointed out that a complete account of the present year's working could not be produced until after the quarterly bills had been paid in February next; but they expressed the opinion that the period during which the works would probably be carried on at a loss, and which had been estimated at from two to three years, would be greatly shortened, and that it would not much exceed one year. Since the meeting of the Council referred to, the Committee had caused an approximate statement of the revenue account to be prepared. They had included therein the total interest and sinking fund charges for the whole year, and the actual expenditure and income up to the 21st ult. To these had been added sums estimated to represent the expenditure which would be incurred, and the revenue which would accrue during the remainder of the year. In the statement referred to, the total expenses were put down at £2588; and the receipts (including a balance of about £4 brought forward), at £4917—showing a difference of £2329. Out of this, £1238 was put down for interest, and £983 for the sinking fund—together, £2221—showing a net balance of £108. The Committee thought the account would show that they were more than justified in the representations they made to the Council, and that there would be an absolute profit, although a small one, upon the first complete year of the electric lighting business. They believed that, with care and judicious management, the undertaking would, in one or two years, prove so great a success as to warrant the Council in reducing the price of electricity. The Committee concluded their report by recommending that application should be made to the Local Government Board for sanction to the raising of £35,000 for the purposes of the electric light undertaking; and that they should be authorized to carry out the works described.

The adoption of the report was moved by Mr. Alderman Moon. In doing so, he remarked that, when the Council embarked in their electric light undertaking, it was never anticipated that, at the end of the first year's working, they would be able to show a profit. But this was nevertheless the fact; it being estimated that at the close of the year there would be a balance of £108. Of course, it was quite impossible to carry on a business of this nature without adding to the capital and stock. At present the plant was being used up to almost its full capacity; and it was high time something was done to add to

it. They must lay down fresh feeding and distributing mains, and provide more plant in order that they might cope with the demands for the light. The cost of the additional mains was estimated at £12,330; and, in conjunction with those which were already laid down, they would reach a main capacity of 62,000 or 63,000 lamps of 8-candle power. Mr. Berry seconded the motion. Mr. Malden thought no allowance had been made in the balance-sheet for depreciation of plant during the year, and that really there would be no profit at all. Mr. Lowther said the Council were bound to take the word of the Committee or prove the contrary. He accepted the accounts as trustworthy; and he considered the report was an honest attempt to give every possible information to the Council. Mr. Daniel supported the Committee, because of the great need of the extension of electric lighting in all the principal thoroughfares; but he thought it a pity that this should have been mixed up with the lighting of the sea-front with the arc light. The colour and ghastliness of that light were intolerable. Mr. Dell contended that there was no need for electric lighting on the sea-front, where there were few people at night. Mr. F. W. Carter, on the other hand, expressed satisfaction at the proposal to light the King's Road. After further discussion, the motion was adopted with only four dissentients.

THE METROPOLITAN WATER SUPPLY COMMISSION.

(*Lord* BALFOUR OF BURLEIGH, *Chairman; Sir* G. B. BRUCE, *Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* W. OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH, *Commissioners.*)

Twenty-fifth Day—Thursday, Nov. 17.

Dr. *T. Dudfield*, Vice-President, and formerly President of the Society of Medical Officers of Health, and Medical Officer of Health for Kensington, was the first witness examined to-day. His evidence was with regard to the quality rather than the quantity of water; but he said he was strongly of opinion that the London supply was adequate where it was constant. As a matter of health, he preferred the constant to the intermittent supply, because in the former case one could always obtain water as it came from the mains, without the intervention of cisterns.

The CHAIRMAN observed that the witness, in the statement he had sent in, remarked that he had had little cause, especially of late years, to complain of the quality of the water in London. What, he asked, caused complaint at any time?

Witness replied that 20 years ago the Chelsea Water Company—one of the three supplying Kensington—drew their water rather low down the river, and their storeage reservoirs were inadequate; and at that time they occasionally sent out water that was unsatisfactory in respect of its appearance—sometimes turbid. They were obliged to send it out too rapidly after, perhaps, being taken in from a flooded river. Since they had established their new works, he had not heard of any cause of complaint. Years ago, too, there was at times complaint of the turbidity of the water supplied by the Grand Junction Company; but he had heard none against that of the West Middlesex Company. As the Medical Officer of Health, he was frequently brought into contact with the sanitary arrangements of the houses in his district; and he saw the water cisterns and pipes, and the water apparatus generally. He was sorry to state that very commonly persons in the better class of houses were oblivious of their duty in the matter of cleansing cisterns. Sufficient attention was not paid to this important matter.

You think that sometimes, when cisterns have not been regularly cleaned, and evil results therefrom, blame is laid on the Water Companies for supplying an impure commodity, when perhaps it is not primarily or wholly theirs?—I should say that, in the majority of cases, that is exactly the state of affairs. Witness proceeded to give illustrations of this. He said he had been asked to examine water unfit to drink; and it had perhaps turned out that a batch of kittens had been thrown into the cistern. Where a case of diphtheria had occurred, he saw hundreds of cockroaches in the cistern. This was some years ago. But only in the previous week a medical officer told him he had found the decomposing body of a woman in a cistern.

Such cases are of rare occurrence?—The unclean state of the cisterns is very common. They are full of slimy vegetable matter.

Has that slimy deposit come through the filters?—I should not be prepared to say that. I imagine it comes from the air.

Mr. HILL: Are these cisterns covered?

Witness: Very often they are not. I am speaking of cisterns in the open air. They are frequently placed over water-closets at the backs of the houses, and are uncovered.

In further reply to the CHAIRMAN, witness pointed out that the covered cisterns were not found in the same relative condition as the uncovered; and he said he thought it fair to infer from this that the impurities were collected from the air rather than brought in by the water. Then another cause of bad water was unclean house filters. At the bottom of them he found sponges; and these frequently contained organisms—no cleansing having been done. The water that came into them was pure and good; but in passing through them, it became impure. Proceeding, he stated that he was strong in his anxiety to see the water supply for drinking purposes quite independent of cisterns; and this would only come about when they had a constant supply for London. When that time came, then practically all reasonable complaint against the water, so far as the Companies with which he was acquainted were concerned, would be removed.

In answer to Professor DEWAR, witness said he should expect a deposit to occur in cisterns covered, and containing the best water; and that deposit should be removed.

By Dr. OGLE: His Society kept watch for typhoid fever cases, and examined into the various outbreaks; and they had not, in his experience of 21 years, found any case of outbreak through the use of London water, while he personally had seen nothing to suggest water as an origin of disease. He did not remember anything that would afford reason for suspecting that any other disease than typhoid—diphtheria, erysipelas, &c.—was communicated by water. Undoubtedly, it was the received opinion of the medical officers that diseases were spread, not through the water, but by means of the air—by infection carried through the air.

By Mr. MANSERGH: Cisterns within houses, under roofs, should also be covered.

In reply to Mr. HILL, who inquired as to why the intermittent supply was not changed into a constant supply, witness observed that the late Metropolitan Board of Works did not call upon any company to give a constant service, and nearly all they had of a constant supply they owed to the initiative of the Companies. But the London County Council had already, in some isolated instances, called for a constant supply, and it had been established; and they had intimated their intention of seeking to extend the system.

Mr. *W. Hunter*, M.Inst.C.E., a Director of the Grand Junction Water Company, a member of the London County Council, and for three years representative of that Council on the Lea Conservancy Board, was the next witness. He stated that for 30 years he had been practically acquainted with the construction of the apparatus employed in water-works; and, as a Director of a Water Company, he had deemed it to be a part of his duty to study closely the evidence submitted to this Commission. In doing this, he had been much struck with the small percentage of water drawn from the Thames, as compared with that abstracted from the Lea—the latter being taken without interfering with the navigation of the river, or injuriously affecting the adjacent populations; and the comparison thus made assured him that there was plenty of water in the valleys of the Thames and the Lea to supply all the necessities of London for many years to come.

Asked by Sir A. GEIKIE to give a sort of outline of the scheme which had been prepared for the Commissioners by witness and Mr. Fraser (the Grand Junction Company's Engineer), the former replied that, so far as the civil engineering part of it was concerned, Mr. Fraser was more responsible than he was. He (witness) had looked at it mainly from the point of view of policy. Their proposal was that water should be taken in at Staines, and stored in reservoirs, which could be increased in number according to requirements and population. Their opinion was that, by proceeding upon these lines, they would obviate the unprofitable expenditure of capital. Money would not be spent on additional reservoirs until they were really wanted. It was proposed to construct a conduit about a mile above Staines. This was where the water would be taken in; and there would be culverts which would lead it up to the reservoirs. The first four of these would be just north of Staines; three others would be south of the main road between Staines and Hampton; and two others, which it was proposed should be constructed last, would be at Wraysbury.

Sir A. GEIKIE: In what way do you suggest dealing with the river from the point of intake? How do you propose to deal with the parties interested in that length of the river?

Witness: We do not provide any compensation for the water we take away. Of course, below the intake there are two or three rivers coming in—such as the Wey and the Mole.

What is the depth of the reservoirs?—It is 40 feet. The water would flow in by gravitation up to 10 feet, and the rest would have to be pumped. I produce particulars of borings, which have been taken at Hampton and other points, varying in depth from 10 to 25 feet before getting down into the clay. It is proposed to carry the trenches down 10 feet into the clay.

Will not that be a rather troublesome operation with this bed of gravel in connection with the river?—It may be a little troublesome; but undoubtedly it can be done. The expense has been provided for in the estimates which have been prepared by Mr. Fraser, in conjunction with Messrs. Aird. The conduit will be tunnelled down to the clay.

Do you intend to keep a constant stream of water in these reservoirs?—That will be as may be found necessary to keep the water in good condition. It will only be a matter of additional pumping, involving a not very large cost. The present estimate for pumping is £6000 or £7000; and it would take another £20,000, if it should be found necessary to pump the whole of the water through. We provide storeage for four months of drought and fifteen days of flood, on the assumption that the flood might come immediately after drought. That provision is made to meet the requirements of the Local Government Board, who consider that the water should be stored some time after it is taken in before being used.

Dr. OGLE: I see all your calculations for the storeage are made on the hypothesis that 200,000,000 gallons of water a day are to be the minimum flow over Teddington Weir. Supposing this minimum were reduced to 100,000,000 gallons, and 200,000,000 gallons a day were required for London, would any storeage be necessary?

Witness: No. We calculate that there will be an ample flow of water, in the most unfavourable year, without taking in flood water.

In reply to questions of detail upon the estimates, witness said that of the 433,000,000 gallons of water per day which was the maximum quantity likely to be required for the supply of the population of London up to the year 1941, they could reckon upon obtaining 153,000,000 gallons from the Lea, the New River wells, and other sources; leaving 280,000,000 gallons a day as the quantity required from the Thames. By this scheme they would be able to get about 300,000,000 gallons a day; and the total cost, with pumping-engines, &c., would be about £5,391,000.

Mr. HILL: What will be the effect of taking these large quantities of water from the New River and East London wells and the Lea? What will be the result, for instance, in the Lea district, if you draw off this quantity of water?

Witness: Personally, I do not believe it will have much effect.

Sir A. GEIKIE: As a former President of the Lea Conservancy Board, did you ever hear complaints made as to the effect on the waters of the valley.

Witness: No.

Supposing these reservoirs are constructed and used, what do you imagine will be the effect on the Thames?—It will not have any special effect on the Thames. We shall always leave as much water as the Conservators desire to have.

You think you can take the quantity you propose without injuring the navigation?—Yes.

Mr. MANSERGH: Did you never hear any complaints of the water pumped from the Lea Valley affecting the navigation?

Witness: I have heard the Conservators say that they have had to do more dredging in the lower region of the navigation, owing to the pumps taking so much water out.

Mr. *A. Fraser*, M.Inst.C.E., was the next witness. Asked by Sir A. GEIKIE under what conditions he had made the plans submitted to the Commission, he replied that he had been instructed by his Board to assist Mr. Hunter in drawing up his statement, &c. In answer to further questions, he said there was a depth of ballast and sand of from 20 to 24 feet over the area of the proposed reservoirs; and at the bottom was the London clay. This applied to all the sites they had selected for reservoirs. Of course, there were many other sites equally valuable; but these had been chosen as being most convenient. Having no houses or public roads upon them, they were singularly well adapted. They proposed to dig down to the clay. They would excavate the ballast, and make up a bank; but they would not cover the floor with anything. The reservoirs would spread over 200 acres, and be 40 feet deep. When they were completed, the water could be made to flow through all, or any series of them, down into the culvert, and so be kept moving. The region of the proposed works was particularly well adapted for the purpose, as there was an area extending some miles through the gravel beds, with plenty of room for extension, which the Company did not possess at Hampton, where they were very much crowded.

Sir A. GEIKIE: You do not propose to deal with the river in any way to compensate for the abstraction of water?

Witness: No.

What would people on the banks of the river say to that?—They would never suffer the same abstraction of water as they do now, because we have provided for a minimum flow of 200,000,000 gallons a day over Teddington Weir. We only take the surplus water, and put it into reservoirs.

You do not show in your plan any filters in connection with the reservoirs?—No; we propose at first to use the present filters. But if a demand should arise for additional filters, they could be erected in the neighbourhood of these proposed new ones.

In reply to further questions, witness said the cost of the new reservoirs would be equivalent to about £180 per million gallons; and the pumping charges were put down at about £2 5s. per million gallons. The scheme was one which had been formulated after consultation among the Companies; and the proposal was that it should not be undertaken by the Grand Junction Company alone, but by all of them.

In reply to Mr. MANSERGH, witness said the water would be taken in at the intermediate stage, after the floods had gone back; so that what was taken would not interfere in any way with the interests of the riparian owners above Staines.

Mr. *Hunter*, recalled, said his strong opinion was that, looking at the matter from the points of view of the public, the County Council, the Lea Conservancy, the London Water Companies, and the consumers, it was desirable and necessary that the Thames and the Lea should be utilized to the utmost extent, before recourse was had to any other watershed. He thought that the Lea was at present proportionally much more used than the Thames, and that the energies of the Water Companies should be given more to the larger river.

Mr. *G. F. Deacon*, M.Inst.C.E., said he was Consulting Engineer to the Corporation of Liverpool, and projected and carried out the great works at Vyrnwy, which provided the city with water. The point which had been referred to him by the London County Council, and upon which he was prepared to give evidence, was as to the scheme suggested by the Thames Conservators for the construction of storeage reservoirs in the Upper Thames Valley, for the purpose of supplying London direct, or for supplying the streams which feed the Thames with a larger quantity of water than now flows in the summer months. On two occasions he had personally examined the ground—not the whole of it, of course—and made himself familiar with its general character. Its most marked peculiarity was the smallness of the summer flow in proportion to the rainfall. This arose in many cases from the jointed nature of the rocks, by reason of which a great deal of the water escaped. He did not see any reason to believe that the water of the Thames itself escaped to any great extent, or failed to pass Teddington Weir. On the contrary, he was inclined to believe that the Thames behaved in very much the same way as other rivers. There was certainly no evidence of a summer overflow of the upper part of the river. The upper tributaries—the Windrush, Sherborne, Cherwell, Sor Brook, Dorne, and Glyme—discharged very little water indeed in summer. The general result of his examination was that the proposed sites were quite unsuited for the construction of storeage reservoirs. He was satisfied that, in the first place, the amount of loss of the rainfall would be larger than had been estimated; and, secondly, that the reservoirs themselves would in many cases lose water by evaporation in the summer weather. As regarded engineering difficulties, he had no doubt whatever that reservoirs could be made in the places suggested, except, perhaps, in the case of the Sherborne Stream. He did not think they could make a reservoir there without putting a puddle wall all round it. If the reservoirs were constructed, they would be very shallow; and, as water-works reservoirs, he should not consider them to be satisfactory. They should be two or three times the length. He was satisfied that there would be a great quantity of vegetation in them. He would not say that the water would be worse, for the purpose of discharging into the Thames, than the river water itself. Asked if the reservoirs could be made water-tight, witness said that, in the case of the Sherborne, it would undoubtedly be very difficult; and he thought it would involve puddle trenches all round it down to the impermeable clay. The Windrush could, he thought, be made water-tight, though there was a little doubt about one part of it, where there was marlstone, the water passing through which would be greater than through ordinary permeable rocks. The Cherwell reservoir, he considered, would not do, as it was entirely in marlstone, and could not be made water-tight. Reservoir No. 4, being on the lower lias, would be fairly satisfactory; but there, again, there was marlstone, which would necessitate a trench all round, in order to prevent a large quantity of water being lost. In regard to the next, there was a great deal of alluvium—very fine mud—which would probably be water-tight. If he were consulted as a water engineer, he would advise against the reservoir, because of the difficulties, although he did not know that it was impossible to construct it. Certainly, he would not undertake to construct it without putting a puddle trench all round; but he did not say it was not possible. At the next proposed reservoir (No. 6), the marlstone was below the water-level; and there would be loss if a trench were not put round. Then they came to the Dorne, where they got on to the oolites, which would cause more difficulty than the marlstone. It would not be water-tight, and was not a proper site for a reservoir. The Glyme was very much the same as the Dorne. In all these cases, there were populous villages pretty close to the rivers, and those villages had drains. Reservoir No. 9 would be water-tight, being on the clay; but it was shallow, as, in fact, were all the suggested reservoirs. He had examined several other sites, but had come to the conclusion that Messrs. Marten and Rofe had selected the best.

In reply to Mr. HILL, who asked how the flow of the Thames at Teddington compared in a dry season with the flow of water in the mountain districts of the North, witness said that it was rather higher per unit of area. It generally fell to nearly a quarter of a cubic foot per second per 1000 acres. In the mountainous districts, the delivery was more rapid, floods were more frequent, and the streams ran down very low for a long period. In the Thames, where the delivery was more uniform, they did not get this. The water became low for three weeks or a month; whereas this state of things lasted in the North for two or three months.

Professor DEWAR: While you say that these reservoirs are not such as you would recommend, you would not, I suppose, raise any objection to the water to be stored in them, if that water were discharged into the Thames and utilized lower down?

Witness: I am not prepared to say the water would be worse for being stored in these reservoirs. I believe that there would be much greater loss than is anticipated, and that the reservoirs would not do the work expected of them.

But do you think that, if the water stored in these reservoirs were subsequently sent down to the filter-beds, there would be any deterioration?—I should doubt whether you would be able to measure the difference, presuming you did not draw off the water in the reservoirs right down to the bottom.

If it was discharged into the river under ordinary conditions, to make up for an exceptional period, and taken in at the present intakes of the Water Companies and filtered as now, you do not think any difference in the quality of the water would be perceptible?—I do not think chemical analysis would show any difference.

Mr. MANSERGH: Which do you consider would be best—reservoirs such as those advised by Mr. Hunter at Staines, or like those you have been describing?

Witness: Artificial reservoirs like those at Staines.

Would there be much difference in expense? Those at Staines are estimated to cost £180 per million gallons?—I think some of those proposed in the Upper Thames would cost more.

Asked as to sewage farms, witness said he had no direct experience of them on the Thames. But he had reason to know that, in one case where sewage treatment had been adopted, the whole of the sewage was not caught; and it was not known how much of it went into the river. If the supervision was no better in sewage farms on the Thames than it was in other districts he knew of, a large quantity of crude sewage must be discharged into the river; and he believed this state of things would become worse rather than better.

Mr. MANSERGH: Is that only in flood times?

Witness: No; at all times. After the first operations have been completed, the separation of the storm waters from the sewage is very difficult to arrange for. After a time, people do not know anything about the distinction between the two classes of drains; and sewage connections are made with the rain-water drains, through ignorance or carelessness. I cannot suggest any remedy, except that the system of supervision should be more strict.

Are you aware that there has been a great extension of sewage treatment in the Thames Valley?—Yes.

Do you suggest that it is not advisable to continue the more modern system?—I think it is advisable. What I complain of is that, where a sewage farm has been working satisfactorily, the strictness with which house drains are watched is relaxed; and there is not sufficient supervision to see that householders put their sewage into the right drain.

Mr. *A. R. Binnie*, M.Inst.C.E., the Chief Engineer of the London County Council, handed in a statement of his views in regard to the reservoirs in the upper reaches of the Thames suggested by the Thames Conservators. He said he was not prepared to express any views upon the proposed reservoirs at Staines, having had no opportunity of investigating the scheme. One particularly objectionable point about the reservoirs suggested in the upper valley was their shallowness. He had had sections made on the assumption, which he thought was not far from the truth, that the fall of the stream in each case was uniform. He found that there would be the following lengths, all with a less depth than 10 feet—viz., No. 1, 1144 yards; No. 2, 580 yards; No. 3, first arm 880 yards, second arm 616 yards; No. 4, 1232 yards; No. 5, 1144 yards; No. 6, 1320 yards; No. 7, 704 and 1320 yards; No. 8, 809 yards; and No. 9, 1496 yards.

The CHAIRMAN: What do you regard as the advantages or otherwise of a shallow reservoir?

Witness: From my own experience, I should say that it is almost impossible to retain water for potable purposes in shallow reservoirs of this kind. The water in summer time becomes exceedingly charged with various organic matters, both vegetable and animal; and, under the heat of the sun, directly the reservoir begins to fall, that matter commences to decay, and gives to the water a very disgusting smell and taste. In my own experience, I have had to abandon a whole reservoir on that account. That was in connection with the Bradford water supply. It was a small service reservoir, having an extreme depth of 30 feet, running, as in these proposed reservoirs, up to a shallow. In 1882 we had to empty the whole reservoir, and a remedy had to be applied by deepening it.

Was the deterioration of the water such as to render it permanently unfit for use?—I could not say. We ran it off immediately, and deepened the reservoir. Of course, I cannot state what would have happened if the water had been kept through the winter.

What was the deterioration caused by?—Owing to the heat, the whole of the upper part of the reservoir became charged first with vegetable matter, among which were living organisms feeding upon it. As the water began to lower, that vegetable matter became exposed to the air and decayed, causing an unpleasant smell. This became noticeable directly we began to draw down the water. The case is comparable to what might happen with these proposed reservoirs, except that the risk would be accentuated here by their having a larger margin. There was no suspicion in the Bradford case of the reservoir having received drainage from cultivated lands or dwelling-houses, as the gathering-ground was pure peaty moorland.

By Mr. HILL: There is one possible mode of making these reservoirs water-tight; but the expense would be of a gigantic character. The upper ends could be deepened by excavation, and the whole lined with concrete, like the ornamental water in St. James's Park. I reckon that this would cost £9,600,000, exclusive of the cost of excavation.

Mr. MANSERGH: Would it not be cheaper to make puddle trenches all the way round?

Witness: Of course; but I have not gone into that, because I have not satisfied myself as to the depth it would be necessary to go. If I remember rightly, there is no special provision in the scheme for flood water, so that all the water, in whatever condition it comes down, would have to go into the reservoirs.

In answer to further questions, witness expressed his dissent from the estimates of the quantity of rainfall that might be expected to be available for these reservoirs—a point on which their success or otherwise must largely depend. He was probably the only witness who had been before the Commissioners who could speak of cholera from the experience of having had it. This was in India, during an outbreak which was distinctly traced to impure water, obtained, as was usual in India, from shallow temporary wells, and filtered through the sand of the district, so that when received into any vessel it looked as clear as crystal. Cholera was endemic there, until the outbreak to which he had referred led to the construction of water-works, and the introduction of an absolutely pure supply of water, when the deaths from the disease, which had amounted to 4369 in the previous seven years, fell to 177—many of the latter cases being known to be imported; and meanwhile the cholera was increasing in the whole district outside the limits of the new water supply. Facts of this kind were very striking, and might be traced throughout the official reports of cholera outbreaks since 1848. They might get water perfectly bright and sparkling, filtered through a great thickness of sand and gravel, and yet fatal to drink. He believed the question of freedom from cholera and other germs was not a matter of filtration at all. The well waters of London, although perfectly clear and sparkling, had been the cause of severe outbreaks of cholera.

Dr. OGLE: What wells do you refer to?

Witness: Those that existed prior to the 1848 outbreak, when they were shut up; the authorities being then convinced that they were the source of danger.

Dr. OGLE remarked that, whatever might have been suspected, it was only proved in one case—that of the Broad Street well—that the well was the source of the disease; and in that case it was found that a privy actually drained into the well

Professor DEWAR: Can you give the Commission any case of an outbreak of cholera or other disease caused by a river water filtered and treated the same as that of London?

Witness: No.

This completed the witness's evidence.

The CHAIRMAN stated that the next public sitting would be on Friday, Dec. 16, for the reception of evidence; and that he would then make a further announcement as to the future course of the inquiry.

The Blackburn Gas Explosion Case.—The case of *Paterson v. The Mayor and Corporation of Blackburn*, arising out of the fatal gas explosion in that town, was again in the paper of the Court of Appeal last Thursday; the Corporation being announced to apply (for the second time) for a stay of execution, pending their consideration of the wisdom of carrying their case to the House of Lords. But upon the case being called, no one appeared on either side; and their Lordships ordered it to be struck out. At the meeting of the Blackburn Town Council last Thursday, a resolution of the Gas Committee appointing a Sub-Committee to deal with the claims sent in by the sufferers from the explosion, was confirmed. The Sub-Committee are also to consider in what way the money for the purpose shall be raised.

The Water Supply of Pudsey and District.—A somewhat serious hitch has arisen in the negotiations between the Bradford Corporation and the Local Boards of Pudsey, Farsley, and Calverley, in regard to the water supply of the district. A deputation waited upon Mr. M'Gowen (the Bradford Town Clerk) last Thursday for the purpose of deciding upon the wording of the agreement. It was then found that the Bradford Corporation objected to the admission of any wording which could be construed into an acknowledgment that the Boards would possess liberty of action at the end of the 20 years' lease into which they were proposing to enter. The arbitration clause had also been struck out. These alterations have been made since the three Boards confirmed the agreement.

The Agitation among the Gas Workers at Keighley.—A newspaper representative has had an interview with Mr. J. Laycock, the Gas Engineer to the Keighley Corporation, with reference to the allegations made by Mr. Burrows, Secretary of the Keighley Trades and Labour Council, against the management of the gas-works. (See *ante*, p. 956.) He stated that the present arrangement of work and wages was made six weeks since. The men then expressed themselves as satisfied; and the District Secretary of the Gas Workers' Union, who was present, and who had charge of stoking machinery at Birmingham, also expressed himself satisfied. The men obtained 37s. 6d. per week of seven days; and average a fixed number of charges per man. This average was less than in any place in England, except one where machine work was in vogue. But if the average quantity of gas made per man was taken into account, the Keighley men, he believed, were better paid than at any other works in the country. As to stoking-machines having failed at Bradford and elsewhere, he could only say that the statement was, like most of the rest, utterly untrue.

NOTES FROM SCOTLAND.

om Our Own Correspondent.

Saturday.

The Edinburgh and Leith Gas Commissioners had a quiet, but business-like meeting on Monday; and in connection with it, I must congratulate Mr. Kinloch Anderson, the Convener of the Works Committee, upon his adoption of a course which I have frequently advocated as being likely to be beneficial to the Commissioners—viz., the explanation by the Convener of the work of his Committee. So much is done in Committee, that those who are not members of any particular Committee are, without explanations being given, left either to take their information from the minutes, or to accept the word of the Committee; or, if they feel that they cannot do that, to get up and put awkward questions. A few words of judicious explanation by the Convener would go far, with reasonable men, to obviate all this. Mr. Kinloch Anderson has started on the right course, in saying a few words as to the output of gas. That is good; but he might go a little further, and run over the other items. Were this policy adopted by the other Conveners, the business of the Commission would be facilitated, and not only that, but its interests would be conserved. At present, no explanations being given, the pressmen call for reports and publish them—which, if they were furnished with an authoritative statement, they would not trouble themselves to do; and it must be admitted that, in the conducting of a business, there are many things in reports which it is not advisable to let out. Mr. Kinloch Anderson was able to tell the Commissioners that the result of their lowering of the price of gas had been an increase of 579,000 cubic feet in the output during October, as compared with the corresponding month of last year, which is very gratifying.

There was a formal minute before the Commissioners, to the effect that the Works Committee had, when considering the remit "to make further investigations and experiments, if necessary, as to the practicability and benefits to be secured in the manufacture of gas from oil, and to report," instructed the engineers to bring the remit under their notice whenever anything of consequence transpired. This is one of the instances where a little explanation would have been useful. Though not expressed, what is really meant is that the Commissioners should wait till the time arrives when Mr. W. Young, of Peebles, is in a position to put his invention into the market, by granting licences for its use. As I understand that Mr. Young is being asked to allow his process to be introduced at once, it may not be out of place to point out that a few months must yet elapse before the Patent Office regulations allow of licences being granted; and therefore it will be necessary to wait till spring before arrangements can be made for erecting the plant in any other works than those in Peebles, where it has been developed. While on this subject, I may say that the *Peeblesshire Advertiser* of to-day contains the article which appeared in the JOURNAL of the 15th ult., preceded by an introduction, which called attention to the great improvement observable in the illuminating power of the gas supplied to the town.

Returning to the Edinburgh and Leith Gas Commissioners, the most important item of business which they had before them was a letter from the Rosewell Gas Coal Company, offering some first-class cannel for sale. This is something new, because for the past year or two the difficulty has been to procure such coal. The letter stated that the Company had a very large quantity of Rosewell Bog Cannel on hand—a very good coal, which they sold to the Commissioners the year before last at 32s. 10d. per ton, and subsequently to other parties at 35s. per ton. Their output, they said, had considerably increased during the past three months; and they found themselves with a large quantity on hand, which they must dispose of in order to keep their works going. They therefore offered it to the Commissioners at 20s. 10d. per ton, delivered at their works. Such an offer was not to be lightly looked at. In the words of Bailie Archibald, it was a splendid opportunity for getting a quantity of first-class coal. He was afraid that the reading of the letter in public would have the effect of bringing down the price of coal all over the country; and he thought, in the meantime, they should send the letter to the Works Committee. This was agreed to. The letter is of some importance, because it shows the change which has come over the cannel market; and what the Works Committee have got to consider is whether there may not be a further fall in the price of cannel.

Everyone will be gratified to learn of the improvements which Mr. M'Crae has just had introduced into the Dundee Corporation Gas-Works. Mr. M'Crae has always shown himself capable of keeping abreast of the times in all the departments pertaining to a gas undertaking; and now that he has effected a renovation of his secondary-products plant, it may be expected that he will be able to make the most of the materials passing through his hands. The gas-works in Dundee are now about as well equipped as any in Scotland, albeit they do not yet contain some of the more recent improvements—such as mechanical stoking; but doubtless these will come in time, when opportunity offers.

The Dundee Gas Commission require to go into the market for a further supply of 20,000 tons of coal, to carry them through the winter. This is in course of further developing their policy of only purchasing a portion of the year's supply, in the expectation of a fall in the price of coal. The fall has taken place—probably more so than they anticipated, as is seen by the letter read at the Edinburgh and Leith Gas Commission, mentioned in another paragraph of this week's "Notes." The Dundee Commissioners are exceedingly fortunate in the outcome of their policy, and are to be congratulated upon their foresight.

An extraordinary matter has been agitating the Corporation of Hamilton this week. On the 9th of last month, the Gas Manager discovered that, in premises which appear to be owned by one of the Town Councillors, there was a gas-pipe capable of supplying 30 lights, fitted to the main without a meter. Several meetings of the Gas Committee were held to consider the matter; and the gentleman was requested to be present at two of them, but declined. At a meeting of the Council on Thursday night, however, he read a statement in explanation of the affair, in which he said that, when he vacated the premises in 1869, he let them to several different people, all of whom

took their gas supply through meter; and that the portion in which this pipe was, was let as a carriage show-room, in which no gas was required to be burned. He made a complaint that the Gas Manager, instead of consulting him and getting proper explanations of the situation, reported the matter to the Committee. He also alleged that, when his tenants wished to have a meter put on, they requested the then Gas Manager to do so; but no attention was paid to their request. After the reading of this, there were some hot words, one of the councillors declaring that for at least 23 years the fittings were in such a condition that all that was needed was to turn on the gas. The subject was continued in the hands of the Gas Committee. It is an unfortunate affair, likely to cause bad blood in the Council. As to the right or wrong which may be involved in the matter, it is impossible at present to speak—the Committee having yet to consider the evidence which is before them; but it is quite in order to say that the circumstances certainly show that there must have been negligence on the part of someone in 1869, when the premises were subdivided, in not seeing that the pipe through which they were previously supplied was disconnected. That was before the Corporation took over the gas undertaking. It is also competent to say that, when Mr. Ewing (who was recently appointed Gas Manager) discovered the circumstance, he most certainly acted rightly in calling the attention of the Gas Committee to it. Any other course, would have been a dereliction of duty on his part.

The Finance Committee of the Inverness Town Council have had before them a report on the financial position of the Corporation gas undertaking, which is not very edifying reading. It is presented in such a way that it is difficult to understand how the matter really stands; but it appears that £2616 has been lost in the course of the last three years. It is stated that, had the recommendation of the Gas Manager (Mr. Thomson) in 1890, to raise the price of gas by 3d. per 1000 cubic feet, been adopted, the greater part of the loss would not have been sustained. That is satisfactory; but the unsatisfactory part of the report is where it announces that, since May, 1890, bad debts to the amount of £507 have been written off, and that at May last arrears due for gas consumed stood at £3152. The large amount of arrears is explained by delay in sending out accounts after the meters are read; laxity in the collection of the accounts; and the accounts being payable at the Chamberlain's office, instead of having a collector calling regularly for payment. The Finance Committee approved of the recent recommendation of the Gas and Water Committee, that the price of gas should be raised by 5d. per 1000 cubic feet, which will produce £900 a year. They consider the increase need only be for a year or two, until the finances of the undertaking have recovered their position.

No place is free from grumbling. Even in large-souled and magnanimous Glasgow, where gas is sold at 2s. 9d. per 1000 cubic feet, there are people who are dissatisfied. Their complaint is that the Corporation, when they raised the price of gas from 2s. 6d. to 2s. 9d. in July, dated back the rise from May 16—a proceeding which is said to be unfair and unbusinesslike. The complaints, as usual, find outlet in the form of letters to the local press. There is, when looked at in one way, reason in the grumbles, because it is scarcely fair that gas should be consumed for two months on the understanding that it is to be charged for at the rate of 2s. 6d., and then to announce that the charge is to be 3d. higher. The Corporation required to raise a certain amount to square their balance-sheet for the current year; and had they delayed raising the price till November, they would have required at least 4d. instead of 3d. Your readers will remember that in Edinburgh last year the same thing occurred; and the legality of it was questioned (also in letters to the newspapers), with the result that this year the Commissioners, to avoid getting into trouble, fixed the price of gas before May 15. That course, however, has its disadvantages too, because the accounts of the undertaking for the expiring year, and the estimates for the next year, have not then been made up. At the same time, writing to the newspapers to ventilate such a small grievance as is here given vent to, is an indication of a mind which is not altogether "fair"—or, at least, is not large. It would be more honourable to write first to the head of the undertaking, and so learn whether he had an explanation to give.

My attention has been called to a letter which has lately appeared in a Broughty Ferry newspaper, relating to a statement which appeared in these "Notes" on the 15th ult. I took occasion then to refer to remarks by one of the Police Commissioners of Broughty Ferry regarding the better illuminating power and lower price of the gas in the burgh; and I pointed out that no credit was given to Mr. John M'Crae, of Dundee, for what he did in connection with the reconstruction of the works. The writer of the letter points out what I did not, that locally the credit for the improvements had been taken by the Commissioners to themselves, for their astuteness in the purchase of coal; and he wants to know whether the truth lies between the remark of the Commissioner and myself. Well, of course it does. Without cheap coal, a reduced price would have been impossible, and in my remarks I did not dispute that; but the view I took of the matter was that, without Mr. M'Crae's improvements on the works, the use of a cheaper coal would not have been feasible. I hold, therefore, that Mr. M'Crae was more responsible for the improvement than the Police Commissioners; and, of course, it remains true that this fact was not mentioned.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 3.

Sulphate of Ammonia.—There has been a fair demand during the week; but the business is almost entirely confined to dealers' purchases in fulfilment of engagements previously entered into. Hence improved values are not easily obtainable. At all events, the attempts to force prices to a lower level have proved abortive; and when estimating the quantity at present on the market, and to come on, and the actual requirements, there is little room for doubt that prices will be maintained. Large quantities are apparently still required by Continental consumers; and although they are still hoping for favourable opportunities, they cannot clearly put off securing their wants much longer. December sulphate, f.o.b. Hull and Liverpool, is quoted at £10 2s. 6d. to £10 3s. 9d. Nitrate remains steady and unchanged.

LONDON, *Dec.* 3.

Tar Products.—There is no change of any importance in values. Benzol is undoubtedly firmer; and the same remark applies to anthracene, though no large business in either article is reported. Carbolic acid is looking up; and there is a keen competition for what is offering. Stocks in makers' and consumers' hands were never so low as they are to-day. Prices are as follows: Tar, 10s. to 11s. nominal. Pitch, 28s. Benzol, 90's, 1s. 7d.; 50's, 1s. 4d. Toluol, 1s. 2½d. Solvent naphtha, 1s. 1½d. Crude benzol naphtha, 30 per cent., 7½d. Creosote, 1½d. Creosote salts, 18s. Pressed naphthalene, 42s. 6d. Carbolic acid, 60's, 1s. 3½d.; 70's, 1s. 8d.; crystals, 5½d. Cresol, 10½d. Anthracene, 30 per cent., "A," 11d. nominal; "B," 8½d. nominal.

Sulphate of Ammonia.—There is a distinct activity in this market. The forthcoming season is likely to see a larger consumption of sulphate for agricultural purposes. Considerable shipments are being made; and important forward business is also noted at a good advance on to-day's prices. £10 2s. 6d. to £10 5s., less 3½ per cent., is about the market value. Gas liquor is quoted at 6s. to 7s. per ton.

COAL TRADE REPORTS.

Lancashire Coal Trade.—An exceptionally quiet tone is reported throughout the coal trade of this district in all descriptions of fuel. The extreme mildness of the season is considerably curtailing requirements for house-fire consumption—with the result that the better qualities of round coal are hanging upon the market; and, although there is no actually quotable reduction, lower prices are in many cases taken to effect prompt sales. Common round coals also continue a drug, owing to the depression in the iron and other coal-using industries; and both for inland requirements and for shipment, there is only a very poor demand, with low prices ruling. At the pit mouth, steam and forge coals do not average more than 7s. to 7s. 6d.; whilst, delivered at the ports on the Mersey, steam coal can be bought at 8s. to 8s. 6d. per ton. The continued stoppage of mills in the cotton districts is, of course, throwing a large quantity of engine fuel upon the market; but, although a good many cheap special lots are just now being offered, list rates are fairly maintained. Best Wigan Arley does not now average more than from about 12s. to 12s. 6d.; Pemberton four-feet, and second qualities of Arley, 10s. to 10s. 6d.; and common house-fire coals, 8s. to 8s. 6d. per ton. Engine fuel ranges from about 6s. to 6s. 6d. for best qualities of burgy; 4s. 9d. to 5s. 3d., for best qualities of slack; 3s. 9d. to 4s. 3d., for medium; and 3s. to 3s. 3d., for common sorts. Many of the collieries are not working more than four days per week; and even with this restricted output, a good deal of coal is going down into stock.

Northern Coal Trade.—There has been more activity in the coal trade; but though the volume of business has been very well maintained, prices have, on the whole, gravitated slightly downwards. It is not to be wondered at that this is the case with steam coal, so much being sent to ports which are now closing for the winter; but the gas coal trade is now really at about its period of greatest demand. Best Northumbrian steam coal is still quoted at about 9s. per ton f.o.b.; but there is now more desire to secure forward contracts, and thus prices are perhaps slightly easier. Second-class coals are about 6d. to 9d. lower; and steam small coals are fairly steady at from 3s. 9d. to 4s. per ton. Offers of good unscreened bunker coals are made at 6s. 8d. to 6s. 9d. per ton; whilst the best screened coals are rather lower in price than they were. Manufacturing coals are now being largely negotiated for next year's supply; and concessions are being made by coalowners. In one or two instances supplies are being bought at 9d. to 1s. 3d. per ton less than the prices paid under the contracts that are now expiring—that is, for Durham small coals. For gas coals, lower prices are being taken, despite the large volume of the demand just at present. It is doubtful whether the output of gas coals in Durham has ever been so heavy as now; but the production is well taken up. Prices of gas coals vary greatly. Good qualities may be had at from 6s. 6d. up to 7s. 6d. per ton; whilst at least one of the Tyneside collieries—which has a considerable part of its output contracted for—asks 8s. 6d. per ton f.o.b., less discount. For coke, there is a fair demand—especially for the local blast furnaces; and for export, about 15s. per ton is asked for best Durham coke. Gas coke is now being contracted for for next year; and it is said that small contracts have been placed at 6s. 6d. per ton, by cement makers—a considerable fall on recent rates.

Scotch Coal Trade.—In Scotland, the coal trade continues dull. Stocks are accumulating in some districts; and so many waggons are standing loaded waiting for orders, that they are becoming scarce. Orders from the Continent are getting few; but what is telling most is that coalowners in the North of England have taken to cutting prices, with a view to recovering what they lost during the Durham strike. Gas coal is accumulating fast at the pit-heads. The prices quoted are: Main, 7s.; ell, 7s. 9d. to 8s.; splint, 7s. 6d. to 7s. 9d.; and steam, 9s. 3d. to 9s. 6d. per ton. During the past week, the shipments were 150,971 tons—an increase over the preceding week of 2049 tons, and over the corresponding week of last year of 10,735 tons. For the year to date, the total shipments have been 7,041,028 tons—an increase over the same period of last year of 906,190 tons.

The Loss on the Darwen Gas-Works.—A special meeting of the Darwen Gas Committee was held last Wednesday, when Mr. Tomlinson's motion, passed at a Council meeting about a month ago (*ante*, p. 824), with reference to the loss of several hundred pounds last year, was under discussion. Mr. Davies, Chairman of the Gas Committee, reported on the matter; and ultimately, after a prolonged meeting, a resolution was come to—the Committee finding that, with the exception of the leakage in the mains, no blame was to be attached to the management, but that the loss was attributable to the rise in the price of coal, &c.

Fall of a Roof at the Nine Elms Gas-Works.—Shortly before four o'clock on the morning of the 30th ult., the light wooden lean-to roof over the stokers' lobby (a room 17 feet wide by 28 feet long) at the Nine Elms Gas-Works, suddenly collapsed. Nine men were in the lobby at the time, six of whom were injured, though fortunately not to any very serious extent.

An Alarming Explosion at the Todmorden Gas-Works.—Last Friday morning, a rather serious explosion occurred at the works of the Todmorden Gas Company. In a room between the meter-house and the mechanics' shop were two ammonia-stills; and, at the time mentioned, one of these exploded. The still was carried bodily through the roof, alighting on a piece of vacant land which adjoins. The brick wall dividing this room from the mechanics' shop was blown clean away; a small engine being smashed to atoms, and the mechanics place otherwise made a complete wreck. A considerable portion of the roof was lifted right off; slates, bricks, stones, and portions of machinery being scattered about the scene of the explosion for a distance of several yards. It was exceedingly fortunate that the explosion happened during the men's breakfast time.

The Guiseley Local Board and the Water-Works.—At last Wednesday's meeting of the Guiseley Local Board, the Chairman (Mr. Enoch Watkinson) read a letter from the Secretary of the Water Company (Mr. W. Walker), which stated that the shareholders had resolved to offer the plant and works to the Board at £1 3s. per pound on the share capital. The balance-sheet showed that the share capital was £4495; and the loans amounted to £2983. The first dividend paid was 3½ per cent. in 1862; and for the past fourteen years, the average had been 5 per cent. In the discussion which ensued, some of the members expressed the opinion that the present works were not equal to the requirements, and that it would be necessary to make large extensions. Ultimately the Engineer to the Board was instructed to survey the works and gathering-ground of the Company, and report thereon.

Water Supply for Trade Purposes at Liverpool.—For some time the Liverpool Corporation Water Committee have had under consideration a report by Mr. Parry, the Water Engineer, containing important recommendations with regard to water rates and charges; and last Tuesday they resolved that in future the charge for water for trade purposes should be reduced where the consumption was in excess of the present supply. Supposing the consumer is now supplied with a million gallons, he will still be charged at the rate of 7d. per 1000 gallons up to that point; but should his supply be increased, the charge for the additional quantity will be at the rate of 4d. per 1000 gallons. This applies to the water used for trade purposes only; and the concession is made in the hope that it will encourage manufacturers to extend their works in the district. One of the largest firms in the city (Messrs. Macfie and Sons) have written a letter to the papers, in which they characterize the Committee's proposal as "preposterous." By instituting a rate of 7d. for water to be used for trade purposes, and providing that "excess of water already used" shall be charged at the reduced rate of 4d., the Committee would be seriously handicapping those who have hitherto contributed most to the city water-rate, and who have maintained the largest industries, while smaller firms would be enabled to increase their consumption of water to the full quantity used by the larger without paying anything like an equal amount for it. Messrs. Macfie exemplify the injustice of the arrangement by a specific case, wherein it is shown that of two firms using equal quantities of water, but one of which has previously used a much smaller amount and only increased its consumption under the operation of the new rate, the price paid by the latter would be £1100 less than that paid by the other. The Committee, it is said, have the option of adopting a sliding scale of rates, which, while charging equitably for the water actually consumed, will be favourable, instead of discouraging, to the larger businesses.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 984.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices	Rise or Fall in Wk.	Yld upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	16—17	..	6 3 6
100,000	10	,,	7½	Do. 7 p. c	10	10½—11½	..	6 10 5
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
100,000	20	30 Nov.	8	Bahia, Limited	20	11—12*	+1	13 6 8
200,000	5	16 Nov.	7½	Bombay, Limited	5	6—6½	..	5 15 9
40,000	5	,,	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	212—217	..	5 12 10
150,000	,,	,,	9½	Do. New	100	163—168	..	5 10 1
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	31 Aug.	5	Bristol	100	103—106	..	4 14 4
320,000	20	29 Sept	11½	British	20	40—42	..	5 7 1
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½—15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	8—9	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	14 Oct.	13	Commercial, Old Stock	100	232—237	..	5 9 9
165,000	,,	,,	10	Do. New do.	100	180—185	..	5 8 1
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 4
800,000	Stck.	15 June	13	Continental Union, Limited	100	227—232	..	5 12 1
200,000	,,	,,	10	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	19½—20½	..	4 17 7
354,060	10	,,	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	217—222	..	5 8 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	259—264	+1	3 15 10
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 7
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171	..	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	161—166	+½	4 4 3
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	257—262	+3½	3 16 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	152—155	+1½	3 17 5
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	118—121	..	3 6 1
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—127	..	3 10 10
908,000	,,	,,	6	Do. 6 p. c. do	100	165—170	..	3 10 6
3,800,000	Stck.	16 Nov.	12	Imperial Continental	100	220—225	..	5 6 8
75,000	5	30 Nov.	6	Malta & Mediterranean, Ltd.	5	4—4½*	+⅛	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	106—108	..	4 12 7
541,920	20	16 Nov.	5	Monte Video, Limited	20	14½—15½	..	6 9 0
150,000	5	30 Nov.	10	Oriental, Limited	5	8—8½*	..	5 17 8
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—4½	—¼	7 7 4
166,870	10	—	2	Pará Limited	10	2—2½	—¼	—
420,000	100	2 Nov.	6	People's Gas of Chicago— 1st Mtg. Bds.	100	103—107	..	5 12 1
500,000	100	1 Dec.	6	2nd Do.	100	100-105*	+1	5 14 3
150,000	10	—	10	San Paulo, Limited	10	8½—9½	..	—
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	287—292	..	5 6 2
1,350,000	,,	,,	12	Do. B do.	100	232—237	..	5 1 3
230,000	,,	,,	13	Do. C do.	100	241—246	..	5 5 8
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140—144	..	3 9 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225—230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	247—252	..	3 19 5
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	203—205	+2½	3 18 0
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	140—144	..	3 2 6
700,000	50	1 July	8½	Grand Junction	50	104—109	..	3 17 11
708,000	Stck.	12 Aug.	11	Kent	100	273—278	..	3 19 1
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	218—223	..	4 5 2
406,200	100	,,	7½	Do. 7½ p. c. max.	100	192—195	+1½	3 16 11
285,000	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	123—126	..	3 3 6
500,000	100	12 Aug.	12½	New River, New Shares	100	325—330	..	3 13 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	132—135	..	2 19 3
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	148—153	+1½	4 4 11
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	135—140	..	4 12 10
1,155,066	Stck.	15 June	10	West Middlesex	100	241—246	..	4 1 3

*Ex Div.

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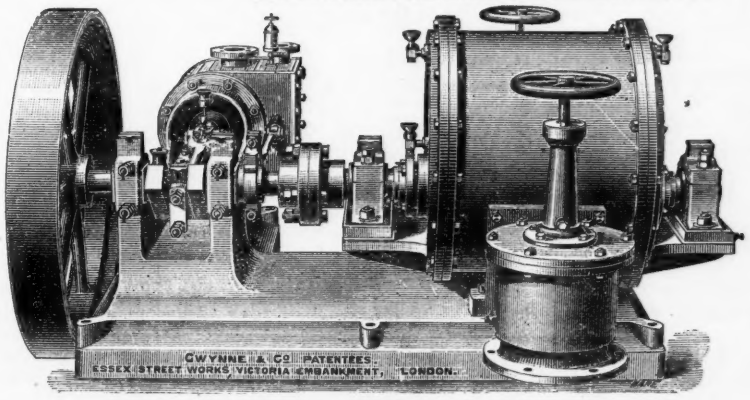

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A 2-horse power ENGINE (in splendid condition), and a new GAS-EXHAUSTER, with 4-inch Connections, £45.
Four 8-inch FOUR-WAY VALVES for Purifiers (Walker's), good condition, £3 10s. each.
Two PURIFIER-COVERS for Boxes 8 feet square, £3 each.
Apply A. E. LAYTON, GAS-WORKS, REDDITCH.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application, OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore
Particulars and price, apply to Mr. T. L. ARCHER, Cathedral Chambers, Half Street, MANCHESTER.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OXIDE OF IRON. Genuine Natural Bog ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.
D. M. NELSON AND SONS, 68, Bath Street, GLASGOW. Telegraphic Address: "Gas, Glasgow." Depôts throughout England and Scotland.

LIQUOR and Tar wanted.
BROTHERTON AND Co., Ammonia and Tar Distillers, LEEDS and WAKEFIELD.

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street London, W.
LUX's Gas Regulators for every consumption.
LUX's single-stem Pressure-Gauges.
LUX's Regulator for Gas-Engines.
LUX's Gas-Balance.
LUX's new Gas Regulator for Inverted Lamps and other Apparatus for Gas Lighting, &c.

BOURNE'S PATENT REGULATOR for preventing oscillation caused by Gas-Engines, Aspirating Meters, &c. The most effective and least costly in the Market. Exclusively adopted by the Continental Union Gas Company, Limited. Over 16 in use. The Inventor would be glad to receiv OFFERS for the right of MANUFACTURING them in England.
Apply to C. BOURNE, Via S. Sofia, 25, Milan, ITALY.

FOR SALE—A perfectly new 20,000 cubic feet per hour EXHAUSTER, with Steam-Engine combined, including Hydraulic Gas Governor, Bye-Pass Valves, and Connections.
For further particulars, apply to Mr. T. G. MARSH, 41, Corporation Street, MANCHESTER.

SALE of Witton Park Gas-Works, Wear Valley Hotel, Bishop Auckland, Tuesday, Dec. 13, 1892, at 3.30 in the Afternoon.
For further particulars, see Bills at Principal Railway Stations; or apply at the Gas-Works.
Auctioneer: JOHN PALLISTER, Manor House, Crook Co. Durham.

IN consequence of Extensions, the Ramsgate Corporation Gas Department have the following VALVES FOR SALE:—
Eleven 14-inch, C. and W. Walker's make,
One 12-inch, Owen and Mann's make,
Three 12-inch, Burton, Sons, and Waller's make.
All in fair condition.
Offers to be sent in at once, addressed to the Chairman of the Gas and Water Accounts Committee, endorsed "Valves."

CAST-IRON TANK AND GASHOLDER FOR SALE.

THE Chelmsford Gaslight and Coke Company have for immediate disposal a CAST-IRON TANK, 32 ft. diameter by 17 ft. 6 in. deep, and a GASHOLDER, 30 ft. diameter, complete with columns (five in number), Guides, Pulleys, Inlet and Outlet Pipes, Valves, &c.
Any further information to be had of the undersigned on application.
E. G. SMITHARD,
Engineer.
Gas-Works, Chelmsford,
Nov. 11, 1892.

CORPORATION OF LEICESTER.

RETORTS AND FIRE-BRICKS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS.
Specification, Quantities, and Form of Tender, can be obtained from the Engineer.
Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m. on Saturday, Dec. 10, 1892.
The Committee do not bind themselves to accept the lowest or any tender.
ALFRED COLSON, M.Inst.C.E.,
Engineer and Manager.
Gas Offices, Millstone Lane,
Leicester, Nov. 18, 1892.

THE Directors of the Worksop Gas Company invite TENDERS for the purchase of the surplus TAR and the AMMONIACAL LIQUOR made at their Works from the 1st of January, 1893, to the 31st of December, 1893.

Tenders for Tar to state price per ton at the Company's Works.

Tenders for Liquor to state price per ton as tested by No. 1 Twaddel's Hydrometer, also at the Company's Works.

The Directors do not bind themselves to accept the highest or any tender.

Tenders to be sent in by the 24th inst.

Worksop, Dec. 2, 1892.

SOUTHWARK AND VAUXHALL WATER COMPANY.

TO PIPE FOUNDERS.

THE Directors are prepared to receive TENDERS from Manufacturers willing to supply CAST-IRON WATER-MAINS and SPECIAL CASTINGS required by the Company.

Specification and Form of Tender may be obtained at the Company's Office upon payment of 10s. 6d., and the same must be sent in not later than the 12th of December, 1892, addressed to the Chairman, Southwark and Vauxhall Water Company, Southwark Bridge Road, S.E., and endorsed "Tender for Pipes."

The Directors do not bind themselves to accept the lowest or any tender.

Southwark and Vauxhall Water Company,
Southwark Bridge Road, Nov. 30, 1892.

HARTLEPOOL GAS AND WATER COMPANY.

TO IRONFOUNDERS, ETC.

THE Directors of the above Company are prepared to receive TENDERS for the several Works and Materials required in the construction and erection of a RETORT-HOUSE ROOF, 73 ft. 8 in. wide, and 126 ft. 10½ in. long; also a ROOF for a COAL-STORE, 14 ft. 4 in. wide, and 106 ft. 10½ in. long, both internal measurements.

Plans and Specification may be seen, or any further information obtained, on application to the Company's Engineer, Mr. Thomas Bower, who, if desired, will supply copies of the plans.

Tenders, on form prescribed, and sealed and endorsed "Tender for Retort-House Roofs," to be sent to Mr. Thomas Trewhitt, Secretary, Gas and Water Company, West Hartlepool, not later than Wednesday, the 11th day of January next.

The Directors do not bind themselves to accept the lowest or any tender.

By order of the Directors,
THOMAS TREWHITT,
Secretary.

Gas and Water Company's Offices,
West Hartlepool, December, 1892.

ROCHDALE CORPORATION.

TO RETORT MAKERS, ETC.

THE Gas Committee of the above Corporation invite TENDERS for the supply of such quantities of FIRE-CLAY GOODS (Retorts, Bricks, &c.) as they may require during the Year commencing the 1st of January next.

Forms of Tender and full Particulars can be had on application to Mr. T. B. Ball, Manager, Gas-Works, Dane Street, Rochdale.

Tenders, endorsed "Fire-Clay Goods," must be sent to me not later than Noon of Wednesday, the 14th of December next.

By order,
ZACH. MELLOR,
Town Clerk.

Town Hall, Rochdale,
Dec. 2, 1892.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCKS and BONDS, WILL BE CLOSED at One o'clock p.m. on Saturday, the 10th prox., for the Half Year ending on the 31st prox., and will be re-opened on the Morning of Monday, the 12th prox.

The Interest for the Half Year will be payable on the 2nd of January next to the Proprietors registered on the closing of the Books.

By order,
JOHN ORWELL PHILLIPS,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 29, 1892.

SOUTH METROPOLITAN GAS COMPANY.

£25,000 Five per Cent. Perpetual Debenture Stock of the above Company, presenting an Investment of the soundest description.

MESSRS. G. A. WILKINSON and SON are instructed by the Directors to SELL by AUCTION, at the Mart, on Friday, Dec. 9, at Two o'clock precisely, in numerous lots, to suit large and small purchasers, £25,000 of FIVE PER CENT. PERPETUAL DEBENTURE STOCK of the South Metropolitan Gas Company.

The districts supplied by the Company comprise nearly the whole of the South of London, from Wandsworth to Plumstead Marshes; and the demand has so much increased that the supply of Gas has been nearly doubled within the last Ten Years.

Particulars may be had of FRANK BUSH, Esq., Secretary of the Company, 709A, OLD KENT ROAD; of Messrs. BUDD, JOHNSONS, AND JECKS, Solicitors, 24, AUSTIN FRIARS; and of Messrs. G. A. WILKINSON AND SON, Surveyors and Auctioneers, 7, Poultry, CITY.

THE NEWLY-PATENTED BOWER REGENERATIVE GAS-LAMP.

VERY many thousands of Lamps under the old Patents sold, and four Gold Medals and other Prizes have been awarded to them in open competition; but the NEW LAMP *gives a much better light than the old one*, and is cheaper and more durable.

Particulars of GEORGE BOWER, St. Neots, HUNTS.

TENDERS RECEIVED FOR DESIGNS FOR THE ERECTION OF MUNICIPAL GAS-WORKS FOR THE IMPERIAL ROYAL CITY OF VIENNA, AUSTRIA.

THE Council of the City of Vienna, Austria, herewith issue a general invitation for a Competition for the working out of a project for the construction of GAS-WORKS, which invitation extends to Experts at Home and Abroad.

The Gas-Works to be erected are intended to furnish the necessary Gas for Public Lighting, as well as for the lighting of the Public and Private Buildings within the entire Municipal District of the City, with the exception of that part thereof for the lighting of which contracts are in force with the Austrian Gas Lighting Association. The projected Gas-Works must, therefore, be prepared for an annual production of 100,000,000 cubic metres, and for a maximum daily production of about 500,000 cubic metres.

The details about the construction of the Gas-Works, and about the way in which the Project is to be worked out, are contained in the programme furnished gratis, upon application, by the City Construction Office (Stadtbauamt) to Competitors.

The Gas-Works to be projected must be completed and ready for operation by Nov. 1, 1893.

Plans and other Papers required by Competitors for working out the Project may be had after to-day from the City Construction Office (Stadtbauamt), against payment of 100 florins, Austrian currency.

The Projects must be delivered (well sealed), at the latest on May 15, 1893, at Noon, at the Evidence Bureau of the City Construction Office in the City Hall (Evidenz-Bureau des Stadtbauamtes im Rathhause Wien).

For the Projects which are best executed and perfectly corresponding to the programme, the following prizes have been fixed: One prize of 8000 florins. One prize of 5000 florins. One prize of 3000 florins.

The awarding of the prizes takes place by a jury which has the sole and unlimited right for making these awards.

Only so many prizes will be awarded as there are Projects presented meriting a prize.

The Plans, Papers, &c., relating to the competition have been submitted to the members of the jury for examination, who have pronounced their agreement in every respect.

All other regulations about the Project and the competition are contained in the programme.

THE MAGISTRATE OF THE
IMPERIAL ROYAL CAPITAL AND RESIDENTIAL CITY.
Vienna, Nov. 15, 1892.

GASHOLDERS

C. & W. WALKER

Have completed a four-lift Holder nearly 200 feet high, of about 8 MILLION cubic feet, at the Beckton Gas-Works, London.

PURIFIERS;

PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT.

PATENT SELF-SEALING RETORT MOUTHPIECES;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SOLE MANUFACTURERS OF WECK'S PATENT CENTRE-VALVE;

PATENT TAR PLANT; CONDENSERS;

SLIDE VALVES; TAR BURNERS; &C., &C.

WOOD SIEVES.

ADDRESSES:

MIDLAND IRON-WORKS, DONNINGTON, NEAR NEWPORT, SHROPSHIRE;

10, Finsbury Square, London.

"FORTRESS DONNINGTON." "FORTRESS LONDON."—Telegraphic.

Price 6s., Cloth Bound, Bevelled Boards.

THE
GUIDE-FRAMING OF GASHOLDERS
AND OTHER PAPERS
CHIEFLY RELATING TO
STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.
BY
F. SOUTHWELL CRIPPS, Assoc. M. Inst. C.E.

Reprinted from the JOURNAL OF GAS LIGHTING. *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application

ALEXANDER RUSSELL & CO.,
Cannel and Gas Coal Merchants,
53, WATERLOO STREET,
GLASGOW.

THOMAS'S JOINTLESS GAS GAUGES.
COWES, I.W.
American Patent for Sale.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production over 3200 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1⅞ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of over
400,000 Tons per Annum.

Full particulars on application to
MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.

TAR, LIQUOR, AND SPENT OXIDE
Purchased for Cash against Delivery.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.
And at STROUD, GLOUCESTERSHIRE.

TAR.

GAS COMPANIES should not sell at the present low price, but use it for heating their Boilers or Retort-Settings with

WALKER'S
PATENT
SPRAY BURNER.

Its Heating Value is Twice as Great as Coke.

APPLY TO
C. & W. WALKER,
MIDLAND IRON-WORKS,
DONNINGTON, near NEWPORT,
SALOP.

WEST YORKSHIRE IRON & COAL CO., LTD.,
LEEDS.

COLLIERIES:
TINGLEY MOOR.
IRON-WORKS:
ARDSLEY JUNCTION,
G.N.R.

CANNEL, GAS, AND HOUSE COALS.
FOUNDRY AND FORGE PIG IRON.

For Quotations and Particulars apply to W. S. PROCTER, Secretary. Postal Address: "LEEDS."

WILLEY & Co.,
Gas Engineering Works, Commercial Road, Exeter.
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for **Extensions** and **Enlargement** of existing **Works,** adapting them to the most **Improved** and **Modern Principle** of **Gas Manufacture.**

PURIFIERS, CONDENSERS. WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority **MR. GEORGE LIVESEY,** of his **CELEBRATED PATENT WASHER,** highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our
WET AND DRY METERS,
which have acquired a high reputation for the **excellence** of Materials and Workmanship; their **durability** and **accuracy** of **Register** guaranteed. They are used by several of the **London Gas Companies,** and over **200 Provincial Gas Companies.**

Price Lists, Specifications and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

ALEX. C. HUMPHREYS, M.E.
General Superintendent & Chief Engineer,
The United Gas Improvement Company, U.S.A

A. G. GLASGOW, M.E.,
Late General Inspector,
The United Gas Improvement Company, U.S.A.

HUMPHREYS & GLASGOW,

Contracting Engineers for Water Gas Plant,
9, Victoria Street, London, S.W.

TAR AND LIQUOR PURCHASED.

JOHN CLARKSON MAJOR,
(Established 1851,)
Tar Distiller and Manufacturing Chemist,
WOLVERHAMPTON.
SCULCOATS, HULL.

For FIRE-BRICKS, the most durable for GAS-FURNACES,
ADDRESS
JAMES WHITE & Co., Limited,
ALBERT WORKS, WIDNES.

BOLDON GAS COALS.
Worked by THE HARTON COAL CO., LTD.,
Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton .	10,500	Cubic Feet.
Illuminating Power .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Danish Gas Company of London, Ipswich Gaslight Company, Devonport Gas Company, Newcastle Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the
HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS.
Are a great improvement on Oil, giving a good Light requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.
43, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

THOMAS TURTON
AND SONS, LIMITED,
Sheaf & Spring Works,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
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T.B.KITTEL, SHEFFIELD.
CONTRACTS FOR SUPPLIES OF ANY
OF THE PRINCIPAL
ENGLISH & SCOTCH
CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON
APPLICATION.
T.B.KITTEL, SHEFFIELD.

CAST-IRON PIPES
FOR GAS AND WATER.
Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.
VALVES
FOR GAS, WATER, AND STEAM.
TELEGRAMS: "PIPES GLASGOW."
WM. MACLEOD & CO.,
56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,
for
CANNEL & COAL.

TYNE
BOGHEAD
CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·68 lbs.

EAST PONTOP
GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

For Prices and complete Analysis, apply to
YOUNG, DANCE, & CO.,
COAL OWNERS, NEWCASTLE-ON-TYNE.
Or E. FOSTER & CO., 21, John St., Adelphi, LONDON, W.C.

THE SILICA FIRE-BRICK COMPANY,

OUGHTYBRIDGE, NEAR SHEFFIELD.
Established 1858. The First Manufactory of Silica and Dinas Fire-Bricks erected in England.
MANUFACTURERS OF

SILICA FIRE-BRICKS,

(TRADE MARK "SILICA")
Specially adapted for Siemens-Martin Gas-Furnaces; also for Gas, Copper, Iron, Steel, and other Furnaces where intense heat is required.
BESSEMER GANNISTER, STEEL-FURNACE GANNISTER, COPPER-FURNACE GANNISTER, IRONFOUNDERS' CUPOLA SAND, FINE-SETTING SILICA CEMENT, STEEL MOULDERS' COMPOSITION.
Our Silica Bricks have gained a high reputation for Unsurpassed Quality in most of the leading Firms in England and on the Continent. Export orders delivered Liverpool, Hull, Grimsby, or the Tyne.

AUG. KLÖNNE,
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REGENERATIVE FURNACES.

Unsurpassed in Efficiency, Economy, Durability, and Easy Working.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

MEIKLEJOHN'S PATENT
Improved Slide-Valve Anti-Dip.

Is perfectly reliable in action, and requires no attention. Has all the advantages of the Dip and Anti-Dip combined.
Is cheap and easily fixed to any form of main.
Will be found the most efficient appliance of the kind yet introduced.
Further particulars and price from

C. MEIKLEJOHN,
GAS-WORKS, RUGBY.
(Late N. MEIKLEJOHN, Longwood.)

UNEQUALLED.
Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

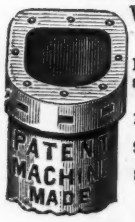
TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

WILLIAM INGHAM & SONS,
Incorporated with the Leeds Fire-Clay Company, Ltd.,
WORTLEY FIRE-CLAY WORKS
Near LEEDS



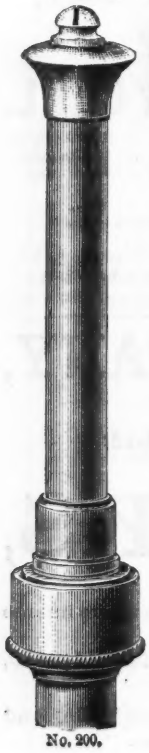
Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT
MACHINE-MADE GAS-RETORTS.

JOHN HALL & CO.,
STOURBRIDGE,
MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
RETORTS CAREFULLY PACKED FOR SHIPMENT.
A STOCK OF DIFFERENT SHAPES ON HAND.

GEORGE ORME & CO.,
MANUFACTURERS OF IMPROVED WET AND DRY GAS-METERS,
ATLAS METER WORKS, OLDHAM.
Telegraphic Address: "ORME OLDHAM." **Telephone No. 93, OLDHAM.**



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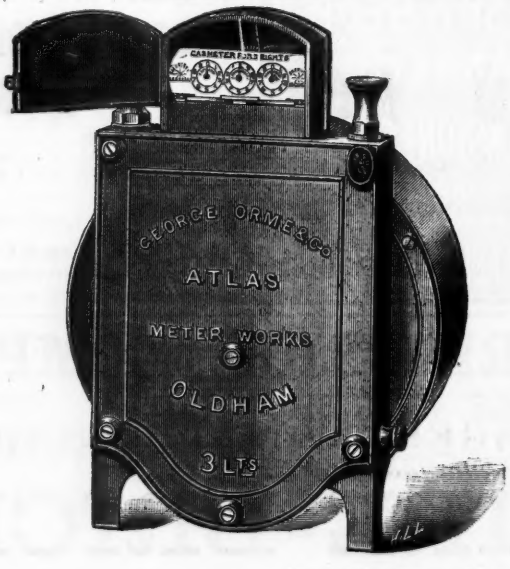
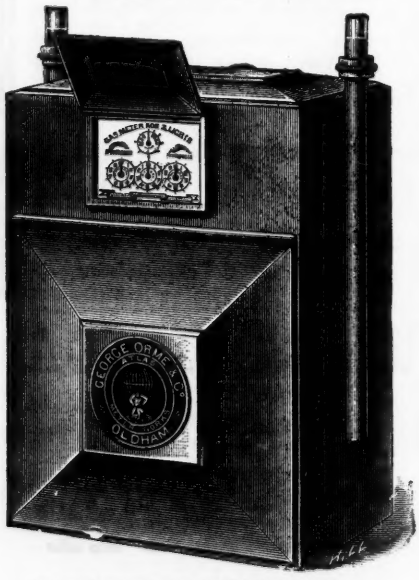


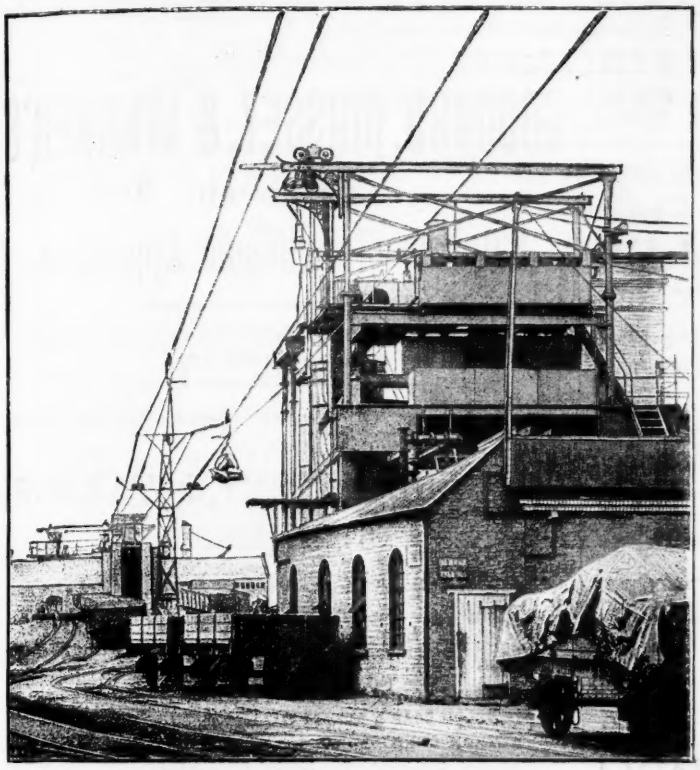
WET GAS-METER IN CAST-IRON CASE.



DRY GAS-METER IN STRONG TIN-PLATE CASE.

ORME'S GAS REGULATOR (BEHL'S PATENT) FOR STREET LAMPS,
AS ILLUSTRATION NO. 200.
Adopted by the leading London and Provincial Gas Companies: **More than 150,000 now in use.**
ORME'S PATENT SUSPENSION REGULATORS.
Prices and full particulars on application.

AERIAL ROPEWAYS.



CHEAPEST AND BEST MEANS OF TRANSPORT FOR

COAL,
COKE,
LIME, ETC.

OVER 500 LINES AT WORK.

Unequalled for passing over Buildings, Rivers, Roads, &c.

CORRESPONDENCE SOLICITED.
EFFICIENCY GUARANTEED.

COMMANS & CO.,
52, GRACECHURCH STREET,
LONDON, E.C.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
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Analysis: 12,600 feet of 19-candle gas per ton.
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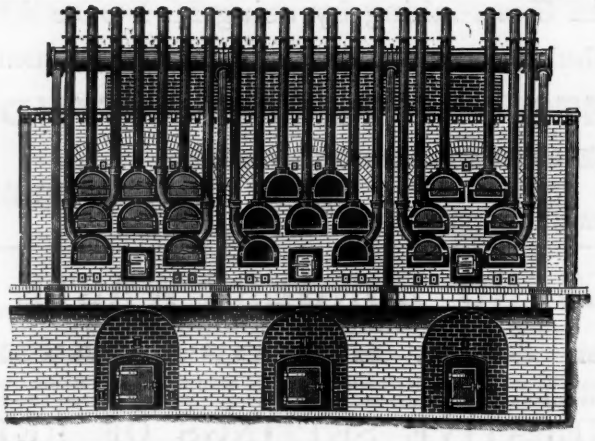

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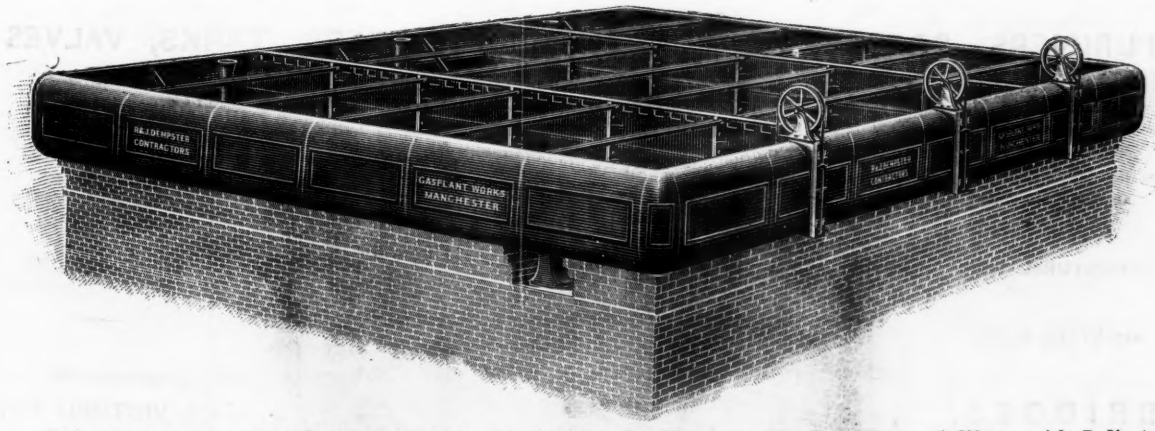

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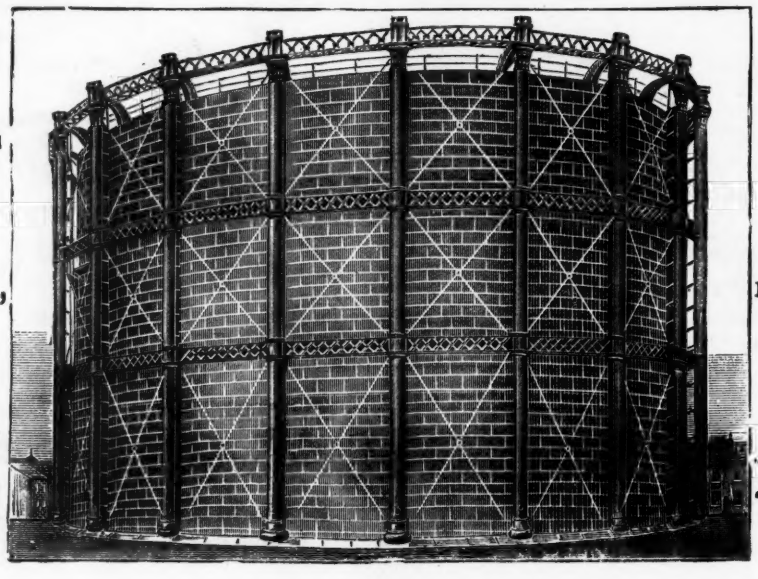

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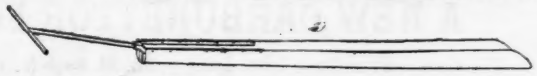

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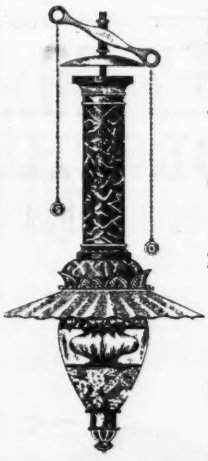

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